Final strategic agenda and implementation plan for each LL after B-WaterSmart

Deliverable D1.4

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869171. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.

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Summary
This report contains the Living Lab final Strategic Agendas as agreed with stakeholders in the Communities of Practice and a description of their development process. Within the final Strategic Agendas, some main achievements during the B-WaterSmart project to achieve the strategic objectives that were set for the specific Living Labs are highlighted. Furthermore, the next steps to realise the Strategic Agendas are elaborated. For some of the Living Labs becoming a Water-Oriented Living Lab and/or a member of the European Network of Living Labs will be a key factor for ensuring the continuation of the Living Lab after the end of the B-WaterSmart project.

Deliverable number	Work package
D1.4	WP1
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Planned delivery date	**Actual delivery date**
31/08/2024	30/08/2024 04/11/2024 (revised version)
Dissemination level	X PU = Public □ PP = Restricted to other programme participants □ RE = Restricted to a group specified by the consortium. □ CO = Confidential, only for members of the consortium

Date	History of Changes
30/08/2024	Initial version
25/10/2024	Version 2: • Provisional assessment of B-WaterSmart LLs for ENoLL added in chapter 2.2.1 including general impact (p. 17) • Provisional assessment of B-WaterSmart LLs for WOLL added in chapter 2.2.2 including general impact (p. 20) • The chapter 2.2.3 was added to show alternative pathways to ENoLL and WOLL for the continuation of LLs and their impact across different dimensions (p. 21-22) • The chapter 2.2.4 was added to describe opportunities and challenges of the general LL concept and all presented approaches (p. 22-24) • Details on which aspects of ENoLL requirements are difficult to meet for the individual LLs included in the “next steps” of all Strategic Agendas (p. 31, 39, 51, 60, 70, 78) • General aspects of ENoLL requirements which are difficult to meet for the LLs included in the conclusion (p. 79-80) • Overview figures of the LLs were included in each Strategic Agenda; in LL Lisbon only the challenges and goals were added to the overview (p. 27, 34, 42, 54, 63, 73) • Textbox describing the opportunities and challenges of LLs was added in the conclusion (p. 79-80) • Link to the URL of the ENoLL self-assessment tool was updated (p.81)

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List of Acronyms and Abbreviations

AEF	Agrar- und Ernährungsforum Nordwest e.V.
AVI	Agency of Valencia
CCRO	Closed-Circuit Reverse Osmosis
CoPs	Communities of Practice
D	Deliverable
DMK	Deutsches Milchkontor
DSS	Decision Support Systems
ENoLL	European Network of Living Labs
ICS-UL	Institute of Social Sciences of the University of Lisbon
INALL	Innovation Alliance
IWAG	Industriewasserversorgungsgesellschaft Nordwest-Niedersachsen GmbH
LAVES	Niedersächsisches Landesamt für Verbraucherschutz und Lebensmittelsicherheit
LL	Living Lab
MS	Milestone
NVE	Norwegian Authority for Waterways
OOWV	Oldenburgisch-Ostfriesischer Wasserverband
QMRA+	Quantitative Microbial Risk Assessment
RO	Reverse Osmosis
SDG	Sustainable Development Goals
trafo:agrar	Universität Vechta - Verbund Transformationsforschung agrar Niedersachsen
UF	Ultrafiltration

UV	Ultraviolet
UWOT	Urban Water Optioneering Tool
VMM	Vlaamse Milieumaatschappji
WE	Water Europe
WELL	Water Europe Living Labs
WOLL	Water-Oriented Living Labs
WWTP	Wastewater Treatment Plant

Executive summary

The B-WaterSmart project aims to transform local challenges, opportunities and ambitions into water-smart societies and economies in coastal Europe and beyond. The project´s Living Labs (LLs) were chosen to enable participation of local stakeholders, reflecting the diversity of challenges in coastal cities and regions (Alicante, Bodø, East Frisia, Flanders, Lisbon, and Venice). Each LL developed a Strategic Agenda, which consists of a future vision of the LL, strategic objectives, and pathways to become water-smart societies. All Strategic Agendas were developed in close alignment with the project´s definition of a water-smart society (D6.3).

D1.4: Final strategic agenda and implementation plan for each LL after B-WaterSmart builds on previous confidential deliverables (D) and milestones (MS) (D1.7, MS6, MS12 and MS22), and presents the final versions of the Strategic Agendas agreed with CoPs stakeholders across each LL. It showcases some main activities of the B-WaterSmart project that support the achievement of the strategic objectives defined for each LL as well as the next steps that are about to follow after the B-WaterSmart project ended.

The Strategic Agendas were defined by following an in B-WaterSmart developed six-step process. The process starts with a definition of the specific vision of water smartness from each LL (Step 1) and the strategic objectives and targets to be achieved (Step 2). To define a starting point the LLs evaluated their current state of the system (Step 3) using the B-WaterSmart water-smartness assessment framework (D6.3). This assessment was used to define milestones (Step 4). To achieve the agreed milestones, LLs engaged the stakeholders through their CoPs to determine the steps and process that will be taken looking at the potential pathways to reach the objectives and targets defined for each strategic objective (Step 5) and the decision-making processes needed to achieve the strategic objectives and targets (Step 6). The descriptions of the final Strategic Agendas in this document summarise the results of step 1, 2, 5 and 6 for each LL. The results of steps 3 and 4 were developed as part of the Innovation Alliance (INALL) process and included in the reporting on the INALL process (D1.5) as well as the B-WaterSmart dashboard development (D3.7).

The LL´s Strategic Agendas were continuously discussed, revised, and agreed upon with CoP stakeholders throughout the B-WaterSmart project. This feedback provided input for adjustments and validation of the Strategic Agendas. To ensure an ongoing discussion of the Strategic Agendas after the end of the B-WaterSmart project, sustainable opportunities of continuing the LLs after the end of the project were

discussed within each LL. Two promising formats to advance LLs and provide a sustainable framework for the future are Water Europe's Water-Oriented Living Labs (WOLL) and the European Network of Living Labs (ENoLL). Both formats and their application processes are shortly introduced within this report and further documents are listed.

The report concludes with some key insights and recommendations for further steps beyond B-WaterSmart.

1 Purpose of this document

The B-WaterSmart project aims at achieving water-smart systemic innovation by applying collaborative work to be more than the production of water-smart methods and technologies. This systemic innovation approach is based on working with key stakeholders from different sectors of activity and fields of knowledge, on developing solutions to societal, regulatory and governance issues, on supporting methodologies to enable systematic and strategic planning for systemic innovation for water smartness, and on capacity building.

The systemic approach was operationalized via:

- Communities of Practice (CoPs) and Focus Group meetings across all six Living Labs (LLs)
- Short courses & Training events or webinars on B-WaterSmart products
- Innovation Alliance (INALL), that was initiated to facilitate the collaboration among the problem owners the six LLs
- Implementation & management of six LL Strategic Agendas

One key result of this systemic approach and process during B-WaterSmart on a regional level is the Strategic Agenda of each LL focusing on the individual future vision, strategic objectives, and the future development of each LL. This Strategic Agendas were developed by the LLs in collaboration with their respective Community of Practice and are presented in this deliverable.

Chapter 2 provides an overview of the methodology used in B-WaterSmart to develop the Strategic Agendas for each LL and introduces general options for the implementation of the Strategic Agenda after B-WaterSmart in form of the Water-Oriented Living Labs (WOLL) by Water Europe and the European Network of Living Labs (ENoLL). The focus of chapter 3 is on the final Strategic Agenda of each LL, its development with the CoPs and their implementation plan after the end of the project. The deliverable ends with a summary of general future steps and recommendations after the B-WaterSmart project.

2 Methodology

2.1 B-WaterSmart Strategic Agenda

In the B-WaterSmart project, each LL (Alicante, Bodø, East Frisia, Flanders, Lisbon, Venice) developed a Strategic Agenda in cooperation with their CoP. The purpose of the Strategic Agenda is to contribute to the realisation of a water-smart future vision developed by the city or region itself.

2.1.1 Development

The first step in the development process was to define a future vision of a water-smart society and economy and to describe the current situation in the LL. To do so, B-WaterSmart has produced and adopted the following definition of a water-smart society:

> *"Societies are water-smart when they generate societal well-being via sustainable management of water resources. In water-smart societies, well-informed citizens and actors across sectors engage in continuous co-learning and innovation to develop an efficient, effective, equitable and safe circular use of water and the related resources. This is achieved by adopting a long-term perspective to ensure water for all relevant uses, safeguard ecosystems and their services to society, boost value creation around water, while anticipating change towards resilient infrastructure."* (D6.3 (Silva, et al., 2023))

This definition, together with the situation of the LLs identified by the LL leaders at the beginning of the project and the planned implementation and operation of the B-WaterSmart technologies and concepts in close cooperation with the respective project partners, form the basis for the individual future visions. Furthermore, based on this, partners and stakeholders needed for a water-smart society were identified and Communities of Practice were formed individually for each LL to implement the systemic approach.

On the way from the present to the future vision, strategic objectives and milestones were defined for each LL to serve as intermediate goals for reviewing the implementation of the Strategic Agenda. The strategic objectives are the overarching goals that organizations, cities, or regions aim to realize towards their "water-smart" vision. Thus, they reflect the transformative features of the water-smart society.

The B-WaterSmart definition of a water-smart society were transposed into a set of five strategic objectives relating to the Sustainable Development Goals (SDG):

Strategic objective A: Ensuring water for all relevant uses

"Strategic objective A, related to SDG 6, aims to ensure that all sectors have access to enough water in terms of quantity, and safe water in terms of quality now and in the future. This links up with SDG 12, responsible consumption, and production, in providing water for both domestic and industrial uses, while ensuring health and safety; SDG 10, reduced inequalities, in terms of availability and accessibility; and SDG 11, on sustainable cities and communities." (D6.3 (Silva, et al., 2023))

Strategic objective B: Safeguarding ecosystems and their services to society

"Strategic objective B, safeguarding ecosystems and their services to society, links SDG 6 to SDG 14 and 15, protecting life below water and life on land, as well as SDG 11, on sustainable cities and societies. The objective describes the ability to prevent deterioration and ensure the protection of water-related ecosystems, enhance ecosystem services, strive towards carbon neutrality, and promote resource efficiency. This will also contribute towards SDG 12, responsible consumption and production, and SDG 13, on climate action." (D6.3 (Silva, et al., 2023))

Strategic objective C: Boosting value creation around water

"Strategic objective C refers to generating economic value from synergies in the water-energy-resources-waste nexus through the implementation of circular economy policies and business models. This dimension is well aligned with Water Europe's vision, and specifically addresses SDG 12, responsible consumption, and production, ultimately linked to the need for sustainable food (SDG 2) and energy production (SDG 7), as well as SDG 11, sustainable cities and communities, and SDG 8, on decent work and economic growth." (D6.3 (Silva, et al., 2023))

Strategic objective D: Promoting adaptive change towards resilient infrastructure

"Strategic objective D, promoting adaptive change towards resilient infrastructure, is about the establishment of planning procedures, their successful implementation, as well as financial and decision-making conditions promoting adaptive change towards resilient infrastructure. This relates directly to SDG 9, which aims to build resilient infrastructure, promote sustainable industrialization, and foster innovation, as well as SDG 3, good health and well-being, SDG 11 and SDG 13, on climate action." (D6.3 (Silva, et al., 2023))

Strategic objective E: Engaging citizens and actors across sectors in continuous co-learning and innovation

"Strategic objective E refers to the broad, iterative process of monitoring, evaluating, and learning water-smart practices amongst all relevant sectors by engaging citizens

in planning, decision-making and implementation. This is linked to SDG 16, in striving for inclusiveness, as well as life-long learning (SDG 4) and sustainable cities and communities (SDG 11).” (D6.3 (Silva, et al., 2023))

As a tool to assess the strategic objectives, a holistic evaluation scheme was developed in the B-WaterSmart project where the strategic objectives can be selected for each LL and evaluated against clear assessment criteria, which are measured through metrics. In addition, specific, quantified targets can be set using such metrics, which can be defined as milestones. These were developed by the users (e.g. local and regional strategic decision makers, but also European and national authorities and research organisations) to develop tailor-made assessments. The assessment framework was integrated into a browser-based dashboard, the B-WaterSmart dashboard (D3.7 (Cauchi, et al., 2024)), which visualises the status quo of target achievement and offers the opportunity to develop strategies for achieving long-term targets. The evaluation approach consists of the before listed five strategic objectives, including fifteen assessment criteria and sixty indicators.

The selection of the strategic objectives of the LLs, the identification of the corresponding milestones individual to the initial situation of the LLs and thus the development of the individual Strategic Agendas was largely carried out through the Communities of Practice meetings with the support of the assessment framework. In the Communities of Practice potential pathways and targets to achieve the milestones and strategic objectives were discussed and identified to support decision making on the measures and solutions to be implemented after the end of the B-WaterSmart project. The individual Community of Practice process of each LL to develop the Strategic Agendas is described in the respective parts of Chapter 3.

The final step of this process is to provide a final Strategic Agenda including the individual future vision, strategic objectives, and an implementation plan for each LL after B-WaterSmart, developed by the LLs in collaboration with the Community of Practice of each LL, which is done in this deliverable.

In summary, the system innovation process for the development of the Strategic Agendas that was applied in the B-WaterSmart project consists of six steps, namely defining an initial vision of water smartness for each LL (step 1), defining long-term objectives and targets of the vision (step 2), analysing the current state of the system (step 3), identifying milestones (step 4), analysing the potential pathways for each LL to achieve the milestones (step 5), and defining the measures and solutions to be taken/implemented for each LL (step 6) (see Figure 1). In this report, the final Strategic Agenda of each LL is presented including the future vision (step 1), the defined objectives (step 2) and the next steps (step 6). Analysing the current state of the system (step 3), identifying milestones (step 4) and analysing the potential

pathways for each LL to achieve the milestones (step 5) were also performed during the duration of the project but as part of the internal discussion of each LL which is documented by Milestone 22 (Glotzbach, et al., 2023).

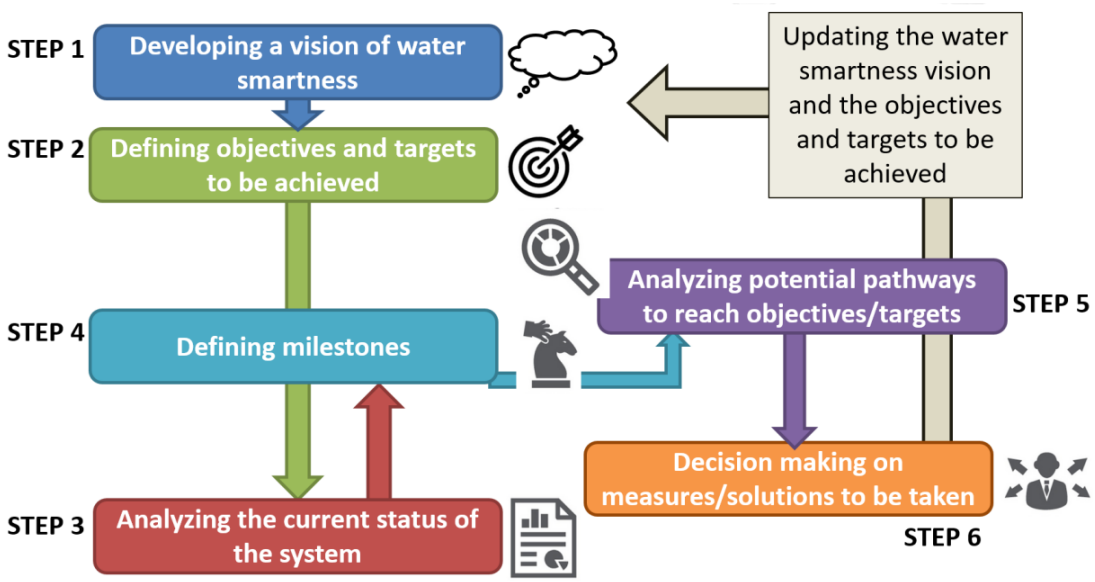

Figure 1: Six-step B-WaterSmart approach for the development of the LL strategic agendas.

2.1.2 Structure

The final Strategic Agenda contains all the information about the LLs needed to understand the context of the region and the future goals and can be used as a stand-alone document by the LLs to present their strategy. Therefore, it starts with a short introduction about the background and purpose of the Strategic Agenda, followed by the definition of the future vision of the water-smart society of LLs.

The main part defines the chosen strategic objectives in the context of the region to realise the future vision of the LL, including the future steps needed to achieve them and the contribution of the B-WaterSmart project.

The last two sections list the main achievements of the LL during the project to come closer to its future vision and the next steps to be taken to ensure the implementation of the Strategic Agenda and the realisation of the future vision after the end of the B-WaterSmart project.

2.2 Continuation of Living Labs

In addition to a possible large-scale implementation of the technical measures and solutions developed in the B-WaterSmart project, two promising formats to advance LLs and provide a sustainable framework for the future were presented and discussed

within each of the LL: the European Network of Living Labs (ENoLL) and Water Europe's Water-Oriented Living Labs (WOLL).

Both formats and their application process were introduced to the LLs as possible future opportunities, which, by the end of the project, led to three applications to WOLL. The individual reasons of the LLs for applying or not applying to WOLL and ENoLL are elaborated in the final section of their Strategic Agendas in Chapter 3. The following chapters provide a short introduction of both formats.

2.2.1 European Network of Living Labs (ENoLL)

ENoLL is a non-profit, independent association of certified LLs and unites LLs from all over Europe and beyond. It seeks to encourage the international growth of LLs as open innovation ecosystems built on cross-border, cross-sector cooperation, and co-creation. The goal is to provide opportunities for members and external stakeholders to advance their knowledge and skills in order to add value to them (ENoLL, 2024).

According to ENoLL LLs *"are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. They focus on co-creation, rapid prototyping & testing and scaling-up innovations & businesses, providing (different types of) joint-value to the involved stakeholders. In this context, living labs operate as intermediaries/orchestrators among citizens, research organisations, companies and government agencies/levels. Within a wide variety of living labs, they all have common characteristics, but multiple different implementations."* (ENoLL, 2024)

Membership of ENoLL provides a comprehensive range of benefits and opportunities within a global network dedicated to driving innovation through open collaboration. ENoLL certification increases the visibility and certification of members. In addition, membership facilitates collaboration by gathering expertise and experience from other members, providing networking opportunities and participation in ENoLL's capacity building programme. Members can also be involved in ENoLL's decision making process and join forces with ENoLL in advocacy activities. In addition, working together in working groups and action-oriented task forces can provide an exchange of best practice and enhance problem solving among members (ENoLL, 2024).

LLs can always apply to become an ENoLL, however, there are two evaluation block per year to assess applications (ENoLL, 2024).

To become an ENoLL eight steps need to be taken (ENoLL, 2024):

1. Contact
   Contact the ENoLL Office (enollnetwork@enoll.org) to receive necessary application materials and general information.

2. Data Collection
   Complete the self-assessment tool and qualitative application form within the specified timeframe.
3. Payment of Evaluation Fee
4. Application
   Send the complete application materials to the ENoLL Office (self-assessment, qualitative application form and payment confirmation).
5. Evaluation
   Three independent LL experts evaluate the application materials, additional information might be requested. The criteria of the qualitative application include comprehensive information, supplementary documentation, timely completion, and the payment of the evaluation fee. The self-assessment is used to assess each LL using the by ENoLL developed harmonized LL evaluation framework consisting of 15 criteria divided in six evaluation chapters – strategy, operation, openness users & reality, impact & value and stability & harmonization (detailed information on the self-assessment can be found here: ENoLL Self-assessment Tool).
6. Approval
   Formal approval of accepted members by the ENoLL General Assembly.
7. Results
   Communication of the final evaluation outcomes by the ENoLL office. There are three different outcomes:
   a. Accepted as Adherent Member
      The applying LL is recognized as a sustainable LL, meeting the criteria of ENoLL, and becomes a full member. The certification is valid for three years.
   b. Accepted as Grow Member
      The applying LL is progressing towards becoming a sustainable LL and there is significant potential. As some areas require improvement, the LL is certified for one year with mandatory participation in the Virtual Learning Lab by ENoLL. The goal is to become a sustainable LL with the support of ENoLL during the membership year. A re-evaluation at the end of the year to become an adherent member is possible.
   c. Rejection
8. Official Welcome

For further information please refer to the following documents:

- ENoLL Membership – Application Guidelines (Wave 2024) (ENoLL, 2024)

This document summarises the ENoLL vision, the benefits of becoming an ENoLL as well as the application process.

- ENoLL Self-assessment Tool (ENoLL, 2024)

  This document provides an overview of all questions of the self-assessment (step 2 of application process). It includes 6 chapters and 15 criteria of sustainable LLs and should be used to collect all information before the online tool is started.

- Introducing ENoLL and its Living Lab Community (ENoLL, 2024)

  This document serves as an overview and introduction to both the global LL network and phenomenon.

- Capacity Building Services (ENoLL, 2024)

  This document provides an overview of services and trainings provided by ENoLL to their members in 2024.

Provisional assessment of B-WaterSmart LLs

The B-WaterSmart LLs undertook the self-assessment test to gain insight into their level of long-term sustainability. ENoLL has a strong focus on the long-term sustainability of an LL. Therefore, six dimensions are assessed with 15 criteria to become an ENoLL. The six dimensions and their criteria are strategy (criteria: governance, business model, culture & collaboration), operations (criteria: human resources, operations, equipment & infrastructure), openness (criteria: innovation partnerships, processes & projects, ownership of results), users & reality (criteria: user-centricity, lifecycle & real-life, tools & methods), value & impact (criteria: co-created values, impact) and stability & scale-up (criteria: stability, scale-up). Overall, these criteria are set at a very high level to really ensure and assess the sustainability of a LL. At the moment, all LLs are not at the organisational level to apply for ENoLL membership. However, ENoLL offered support to work towards achieving the criteria to become a long-term LL according to the ENoLL criteria. ENoLL is suitable to realize impact across all dimensions (environmental, social, political, technological, economic etc.) depending on the objectives of the LL.

2.2.2 Water Europe's Water-Oriented Living Labs (WOLL)

Water Europe (WE) is a multi-stakeholder association focused on achieving a Water-Smart Society. It was established by the European Commission and operates under its Water Vision, aiming for water security, sustainability, and resilience. WE organises its activities into three key programs: Collaboration, Advocacy, and

Implementation, which facilitate networking, raise awareness of water's value, and support the adoption of innovative solutions. Key tools in their implementation efforts include Water-Oriented Living Labs development and support.

WOLLs are defined by Water Europe as *"water-oriented, real-life demonstration and implementation instrument that brings together public and private institutions, government, civil society, and academia to jointly build structured grounds to develop, validate, and scale-up innovations that embrace new technologies, governance, business models, and advancing innovative policies to achieve a water-smart society."* (Water Europe, 2022)

Therefore, WOLLs are collaborative innovation ecosystems that promote the co-creation, testing and evaluation of innovations in real-world environments to achieve a water-smart society. These LLs address challenges such as climate change, demographic trends and the pursuit of a circular economy and energy transition. They are part of Water Europe's implementation tools and can enhance the scale and speed of innovative solutions by providing a "field lab" for community-driven innovation in a multi-stakeholder context. Therefore, WOLLs are a step towards a more systemic approach to contribute to the achievement of water-smart goals in the European context (Water Europe, 2022).

WOLLs are characterized by two main dimensions: scale and maturity. Scale is divided in three different categories: regional (e.g. river basins, public domain), urban (public-private domain e.g. cities) and local (e.g. specific industrial areas or domestic living quarters, private domain). The maturity level of a WOLL is distinguished in three levels - start-up, sustainables and scalables - and categorized using the LL Analysis Model (see Notebook Series #2 (Water Europe, 2022)). Once the highest maturity level is reached WOLLs can be accredited by Water Europe and reach the status of a Water Europe Living Lab (WELL). The long-term goal is to develop a collaborative network of WELLs with a harmonized approach, which will make a vital contribution to realising Water Europe's vision of a water-smart society (see Notebook Series #3 (Water Europe, 2024)). Therefore, the current WOLLs provide a starting point to stimulate growth and development along concrete steps towards the long-term goal to tackle the challenges toward a water-smart society (Water Europe, 2022).

A step towards such a harmonized approach is the development of interoperable WOLLs by standardising processes, e.g. a standardised structure of results to facilitate an easier and feasible exchange of data and results with other LLs. Therefore, LLs that are WOLLs benefit from this role by being able to link other existing WOLLs to their own studies and create twins. This network can lead to larger datasets of comparable tested solutions, an active and inclusive stakeholder engagement, and a new type of water-smart symbiosis of LLs, including an open

innovation environment (Water Europe, 2022).

There is a three-step process to become a WOLL:

1. Mapping WOLLs (Identification and selection)

   The mapping of WOLLs includes the identification and first analysis of possible WOLLs regarding the location, scale and a preliminary evaluation of their maturity. In addition, fifteen basic criteria in the three categories “mission statement”, “focus” and “organisation” are assessed to analyse to what extent the candidate meets the qualification for a WOLL (Water Europe, 2022).

2. Assessing WOLLs

   In this step the LL Analysis Model is applied consisting of a tailored harmonisation cube for the quantitative and qualitative assessment of the candidate WOLLs. It harmonizes methods and tools for analysing the candidate WOLLs and provides comprehensive evaluation criteria for each of the six essential components of a Living Lab, which are: 1) governance; 2) service creation; 3) infrastructure; 4) methods and tools; 5) user involvement; and 6) innovation outcomes (Water Europe, 2022).

3. Evaluating WOLLs maturity levels and planning possible SMART improvements

   When areas for improvement have been identified, a qualitative analysis can be conducted after the quantitative analyses. A WOLL scoring tool can be used to focus on specific areas for improvement and develop an improvement plan based on a SMART approach.

The mapping and assessment of WOLLs is embedded in the EU Partnership Water4All that was launched in June 2022 to enable water security for all in the long term by boosting systemic transformations and changes across the entire research – water innovation pipeline. Water Europe in Water4All leads the Pillar C on Demostration of Innovation through the Water-Oriented Living Labs.

For further information please refer to the following documents:

- Atlas of the European Water-Oriented Living Labs 2024 (Water4All/Water Europe, 2024)

  Embedded in the Water4All Partnership, the ATLAS of WOLLs 2024 is the second mapping and categorisation of WOLLs in EU and beyond and represents the collective commitment to advancing water resilience and promoting cross-sectoral collaboration and territories. This Atlas was

generated following the methodology for the mapping, identification, and assessment of WOLLs explained in the Notebook Series #1 and #2.

- Definitions, Practices and Assessment Methods – Notebook Series #1 (Water Europe, 2022)

  The results of a literature review covering the definition and development of Living Labs are presented in this first of a series of notebook documents on the topic of WOLLs. The review focuses primarily on the methods for assessment and evaluation of Living Labs.

- How to Assess and Evolve WOLLs: A Manual with a Vision – Notebook Series #2 (Water Europe, 2022)

  This document offers helpful and temporary guidelines for WOLL identification, evaluation, and evolution. Its goal is to act as a guide for anyone wishing to use the Living Labs concept to integrate their water-smart innovations into society and advance their research and development process in the direction of a water-smart society.

- Bluebook on Creating Water Europe Living Labs (WELLs) – Notebook Series #3 (Water Europe, 2024)

  This document, also referred to as "The BlueBook", focuses on the development of a more sophisticated approach and accompanying tool for the identification, assessment and evolution of WOLLs towards WELLs, based on the preliminary guidelines of the Notebook Series #2, as well as the promotion of the realisation of Living Labs specifically focused on the realisation of the Water Europe's vision. It also includes an updated mapping and categorisation of European WOLLs.

Provisional assessment of B-WaterSmart LLs

WOLLs differentiate between the maturity levels of LLs and include LLs with a start-up maturity as a precursor to becoming a WELL with the highest maturity. Therefore, LLs are assessed and included as WOLLs or WELLs according to their current status. In the context of B-WaterSmart LL Flanders, LL Lisbon and LL Venice already achieved the status of WOLL, while LL Alicante applied and expects to fulfil it until the end of the year 2024. LL East Frisia and LL Bodø consider an application in the future. WOLL is suitable to realize impact across all dimensions (environmental, social, political, technological, economic etc.) depending on the objectives of the LL.

2.2.3 Other Approaches

In addition, there are alternative methods to becoming an ENoLL or WOLL for sustaining LLs after the end of a project. The different LLs of B-WaterSmart continue their activities e.g. through ongoing or future project partnerships addressing new aspects of LL or using local networks in other ways.

Examples for project partnerships based on the results of B-WaterSmart include LL Alicante's new LIFE MERLIN project to further improve biogas production from co-digestion at the WWTP resulting in an ecological, technological and economical impact, and their "Urban Water Sandbox in Alicante" project granted by the Innovation Agency of Valencia (AVI), which will support the continuation of the Living Lab activities for the sustainability of the water cycle with the involvement of technological and administration stakeholders in the period 2023-2026. This example mainly has an environmental and technical impact. LL Bodø operates on a project-based model and is in the process of optimizing the selection, utilization, and implementation of EU projects to ensure ongoing value for the municipality using the experience from B-WaterSmart to decide the next steps and projects and therefore, deciding on the desired impact. LL East Frisia participates in the Developers of Circular Solutions (DECISO) project, which supports European cities and regions in the development of financing systems for circular economy initiative with a focus on the economic impact. While, in order to develop innovative and feasible processes for recycling filter rinsing water and utilising filter sludge, the FITWAS project is investigating membrane processes with different process concepts and membrane modules/materials resulting in a technological impact. LL East Frisia is also a part of the IWM-H2 project "Integral water management for hydrogen production - development of guidelines for energy industry planning and authorisation procedures", a wide variety of water resources are being examined for the Wilhelmshaven case study region and the district of Friesland with regard to their availability, technical and economic usability and suitability for approval for hydrogen production. In addition, the strategic agenda of LL East Frisia from B-WaterSmart is being further developed in the district of Vechta with the "Wasservision Vechta" project. The main aim of the project is to involve citizens and raise their awareness of the sustainable and conscious use of water as a resource. As part of the project, a vision for water use is to be developed and visualized with the people of the Vechta region. It therefore primarily has an impact on the social and political dimension. LL Flanders participates in the projects Blue Future Limburg, Deeper Blue and Nathalie, which aim to demonstrate effluent reuse directly or in combination with aquifer recharge resulting in a technical and environmental impact.

These examples show that the project-based continuation of LLs can take many

different forms and depends strongly on the needs and situation of the LL. They are not as sustainable and long-term as WOLLs and ENoLLs, but the implementation and complexity is on a smaller scale and therefore has a lower barrier to realisation.

There are also examples for local networks realised in the LLs after the end of the B-WaterSmart project. In LL Alicante Aguas de Alicante has decided to upscale the co-digestion pilot to full scale, moving forward in collaboration with the industry waste providers that have taken part in the Living Lab pilot having an environmental an economic impact. In LL East Frisia the Strategierat Wasser Weser-Ems was established in September 2023 to bundle the efforts of all relevant stakeholders of the water cycle in the region. The aim is to ensure the sustainable use of our water resources in the Weser-Ems region and to establish regional, climate-resilient water management. This impacts the mainly the social, political and economic dimension. In LL Flanders there have been a variety of funding approaches discussed for the buffer basin involving different stakeholders (e.g. farmers, industries, municipalities, and communities), including for example, traditional taxation models to innovative collaborations and sustainability-focused initiatives, to contributions, to cooperatives, to engagement with industries, or innovative partnerships (e.g., creating a multifunctional space around the basin for recreation or leisure). An appropriate business model for the buffer basin in Hombeek will need to be defined to ensure the long-term sustainability of the approach, and to explore potential replication to other parts of the Flanders, which has an economic impact.

The local or other network approach also varies widely. Like the project-based approach, the network approach is on a smaller scale than ENoLL and WOLL, while a high degree of relevance to the actual problem can be achieved. In essence, all approaches are appropriate for realizing impact across all dimensions (environmental, social, political, technological, economic etc.). It strongly depends on the objectives of the LLs and the network it participates in.

2.2.4 Opportunities and Challenges of the Different Approaches

Before examining the opportunities and challenges associated with each approach, it is important to recognise that the LL concept itself presents a unique set of opportunities and challenges that are independent from each approach. Therefore, in Table 1, general opportunities and challenges that the concept of LLs are shown. It is essential for a LL to foster collaboration in order to achieve success. Depending on the development phase of a LL the opportunities and challenges can change (Kalinauskaite, et al., 2021).

Opportunities	Challenges
• Fosters cross-sectoral collaboration • Involves all stakeholders and thereby creates a common understanding and vision • Provides continuity and stability • Enables co-learning and cross-cutting activities	• Requires management and facilitation of social interaction and emotional connections as a sense of belonging between the stakeholders is crucial factor • Requires increased resources, including securing long-term funding • Requires a high level of coordination • Requires guidelines for collaborative work

Table 1: Opportunities and challenges of the LL concept (Kalinauskaite, et al., 2021)

All four approaches presented - ENoLL, WOLL, project networks and other networks - operate at different levels. While ENoLL includes all topics to promote co-creation and open innovation across all sectors, WOLL is, as the title suggests, water-oriented. Both, ENoLL and WOLL, can have impact on all dimensions (environmental, social, political, technological and economic) based on the objectives of their LLs. The project-based and other networks are more specific to a problem or research question on a regional, national or international level.

The criteria to join project networks and other networks depend on i.e. on the funding call criteria, common goals or existing local network structures. LLs can therefore implement structures at different levels according to their needs and resources. In addition to the operational level, it is important to consider the challenges and opportunities of each approach to find a form fitting to the needs of a LL (s. Table 2).

Comparing all approaches the step from a project-based LL to a self-sustaining LL seems to be quite a big one, as additional resources have to be secured in a sustainable way for the long term. As seen in some LLs it can also be an ongoing process over the duration of different projects. Therefore, it is important to consider existing structures like stakeholder communities before deciding whether to establish a new structure or embed within an already existing system. However, once LLs become self-sustaining, value creation beyond the boundaries of a project or funding period as well as the creation of a cross-cutting network is possible.

	Opportunities	Challenges
ENoLL	• Cross-sectoral, cross-border and cross-cutting activities within and among all diverse types of Living Labs • Provides “field lab” as part of a larger orchestrated innovation ecosystem • Fosters innovation for and with actively involved Living Labs • Long-term approach of Living Labs beyond the scope of a project • Structured process to support sustainability of Living Labs • Established networks within different sectors • High level of commitment, knowledge exchange and capacity building for and with Living Labs	• High amount of human and financial resources required to set up and run a Living Lab • High level of criteria for membership to safeguard quality labelled Living Labs • Supporting Living Labs in developing a sustainable governance and financial scheme for the long-term
WOLL	• Cross-topic and cross-cutting activities in the water sector • Guided development process • Fosters innovation • Long-term • Support system for the planning and implementation of projects	• High amount of human and financial resources required (depending on the level of maturity aimed for)
Project Networks	• Clear, defined objectives • User-centred problem solving • Funding • International collaboration possible • High level of commitment (project partners)	• Funding only for limited time frame • Lower emotional involvement of stakeholders • Duration of collaboration usually limited to project timeframe
Other Networks	• Topic-oriented or regional/local focus • Might be a good starting point for ENoLL, WOLL or project networks • Problem-driven	• Requires coordination time • Requires funding or participation on voluntary basis • Fluctuation of participants

Table 2: Opportunities and challenges of different approaches

3 Results

3.1 LL Alicante

3.1.1 Development

The results of the six Community of Practice meetings in Alicante were used to develop the Strategic Agenda for the LL. The 1st Community of Practice meeting was held on 10 November 2021 (in-person), the 2nd was held on 25 May 2022 (online), the 3rd was held on 14 December 2022 (in-person), the 4th was held on 03 July 2023 (in-person), the 5th was held on 21 November 2023 (in-person), and the 6th was held on 29 May 2024 (in-person). All present meetings were held in the Museo de Aguas (Water Museum) in Alicante.

At the 1st Community of Practice meeting, the preliminary general strategic objectives were presented with an overview of the B-WaterSmart project to the stakeholders. For the 2nd Community of Practice meeting an interactive workshop format was chosen. At first, the results of the first Community of Practice were presented to the participants and linked to the Strategic Agenda, which was then analysed. Then, brainstorming tools to gather all ideas and prioritisation tools to rank Strategic Objectives and the initiatives were used. The results were openly analysed in live, and participants were openly asked to clarify or add any additional information to the feedback provided. The 3rd Community of Practice focused on the objectives that should be pursued within Alicante's Strategic Agenda to address agriculture related concerns. Water availability was one of the major concerns of the agricultural sector. As such, supporting regeneration of water is key. Other issues discussed were the need for energy to pump water to the fields and access to sustainable fertilisers. In the 4th Community of Practice, the vision of the participants in relation to Alicante city were analysed and main challenges and barriers of the implementation of reclaimed water and other resources from wastewater plants in the urban area of Alicante identified. For the 5th Community of Practice meeting an interactive approach was chosen to brainstorm about two topics, which are part of the Strategic Agenda: (i) energy production from wastewater and (ii) energy efficiency in water networks, resulting in a preliminary business canvas for both topics. The objective was to discuss possible use cases and business models of the Alicante pilots (co-digestion and energy generation) with local stakeholders. In the final and 6th Community of Practice meeting an overview on the results of the B-WaterSmart project both for the pilot plants and for the Communities of Practice carried out throughout the project were given and common values between all Community of Practice members were used to co-define the final Strategic Agenda for continuing the Alicante LL after the

project ends. The conclusions were set out in the form of a Manifesto on the values that the Living Lab should have as a whole and potential actions to be implemented to achieve these goals.

3.1.2 Strategic Agenda

What it's about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry more towards a circular economy. The findings from the Alicante Community of Practice are summarised in this strategic agenda. The joint planning shows ways in which the region can become "water-smart".

Our Vision

A strategic vision has been defined for LL Alicante, which is to serve as a guideline for all stakeholders involved:

The long-term vision in Alicante is to become more water-smart through converting wastewater treatment plants into biofactories, boosting water reuse through reclaimed water and obtaining energy and valuable products from wastewater treatment.

Our Strategic Objectives

Together with the Community of Practice stakeholders, five strategic objectives have been identified for the realisation of the strategic vision, as illustrated in Figure 2, which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

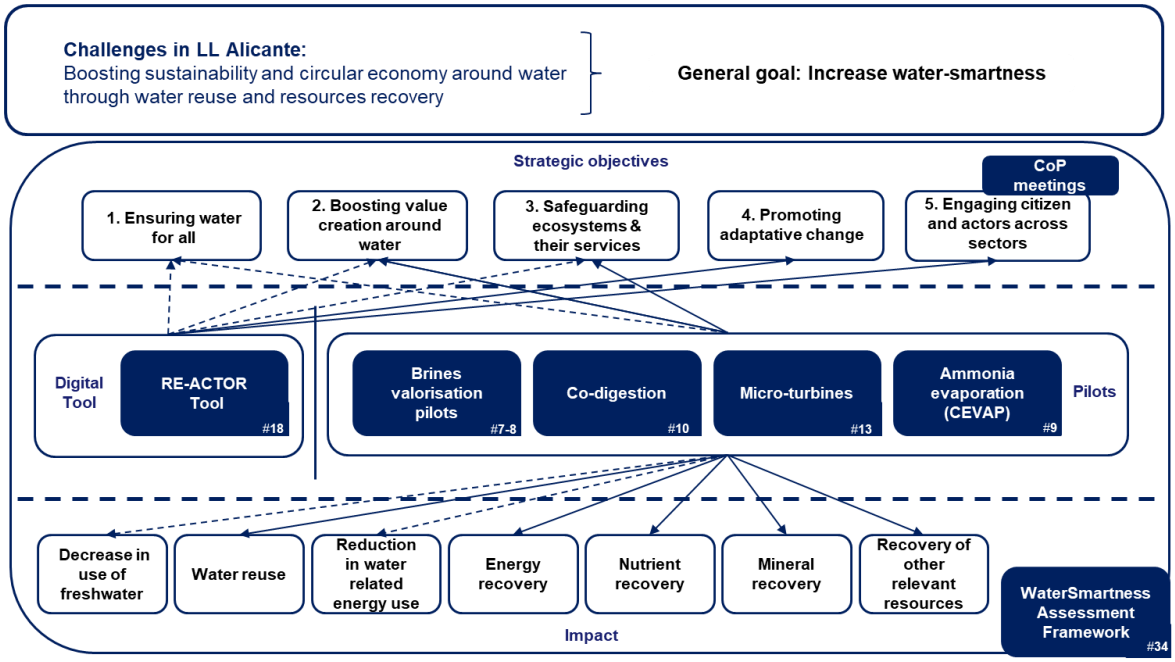

Figure 2: LL Alicante in a nutshell

1 Ensuring water for all relevant uses

All sectors (domestic, industrial, agriculture, environment) should have access to enough and sufficient water in terms of quantity, and safe water in terms of quality now and in the future. Ensuring water for all relevant uses describes the ability that now and in the future all sectors (domestic, industry, agriculture, environment) should be able to have secure and affordable access to sufficient water in terms of quantity and to safe water in terms of quality for the required potable or non-potable purposes. This objective is key for Alicante, due to the historical situation of water scarcity in a semi-arid region with no local water resources.

What do we need to do in particular?

- Increase water reclamation in the territory to reach 100% of treated wastewater
- Reduce use of conventional water resources and particularly groundwater extraction for non-potable uses

Our B-WaterSmart contribution

As part of B-WaterSmart, electrodialysis and electrochlorination were used to recover reclaimed water while transforming concentrated brine water into sodium hypochlorite (NaClO) for water disinfection. The successful results of the brine valorization pilot

through electrodialysis/electrochlorination will allow the use of the sodium hypochlorite produced for the disinfection of reclaimed water at full scale. In addition, the RE-ACTOR tool was developed and allows users to assess the environmental and economic impacts of upgrading scenarios with different technologies and prioritize them.

Additionally, the CoPs reinforced the alliance with all the relevant stakeholders to work together for the goal of maximising water reclamation and water use efficiency.

2 Boosting value creation around water

The value creation from synergies in the water-energy-resources-waste nexus through the implementation of circular economy policies and business models supports a transformation to a water-smart society.

What do we need to do in particular?

- Increase energy recovery rate from water and energy self-sufficiency of wastewater treatment plants
- Recover nutrients from water and implement related business models
- Create new business models related to the recovery of other resources (e.g. sodium hypochlorite production from brines)

Our B-WaterSmart contribution

In the scope of B-WaterSmart the energy self-sufficiency of wastewater treatment plants was supported by microturbines, which enable the recovery of electric energy through the vortex flow of water effluents in Wastewater Treatment Plants (WWTPs). In addition, B-WaterSmart's combination of sewage sludge and other substrates with higher biodegradability in the anaerobic digester leads to improved biogas production and thus increased energy production from a renewable source. The results of the pilot so far show that the co-digestion has the potential to double biogas and energy production, which could lead to energy savings between 70.000 €/year and even more than 300.000 €/year depending on the availability of external waste as co-substrates and its biodegradability.

The recovery of nutrients was realised in Alicante with an evaporation-based technology known as CEVAP. CEVAP is a low-thermal cartridge evaporator technology used to recover ammonia from reject water generated during sludge dehydration. Ammonia could then be used as a nitrogenated fertilizer for agriculture or for NOx abatement in industrial processes. CEVAP operates at low temperatures and recovers nutrients sustainably. A product stream with 5 g/L of ammonia was achieved, which is exceeding the feed water concentration by a factor of six.

However, this result remains distant from the concentration of a commercial reagent.

3 Safeguarding ecosystems and their services to society

Water-related ecosystems provide multiple benefits and services to society and are essential for reaching several SDGs. Water-related ecosystems have significant economic, cultural, aesthetic, recreational and educational value. They help to sustain the global hydrological cycle, carbon cycle and nutrient cycles. They support water security, they provide natural freshwater, regulate flows and extreme conditions, purify water, and replenish groundwaters. Safeguarding ecosystems and their services to society describes the ability to prevent deterioration and ensure protection of water-related ecosystems, to enhance ecosystem services in urban and rural areas and to take carbon neutrality actions and promote resource efficiency in view of environmental protection.

What do we need to do in particular?

- Implement solutions to minimise negative impact of water systems (eutrophication, generation of brines)
- Improve through water reuse services to society and ecosystems health

Our B-WaterSmart contribution

The electrodialysis and electrochlorination treatment train aims to valorise RO brines by recovering recycled water and sodium hypochlorite (NaClO). This will reduce the discharge (nutrients, salts) into receiving waters (i.e. the sea) and minimise the impact on aquatic ecosystems.

4 Promoting adaptative change towards resilient infrastructure

The existence of governance, financial and decision-making conditions promotes adaptive change towards resilient infrastructure and enables robust planning and its implementation while assessing the effectiveness in terms of resilience.

What do we need to do in particular?

- Improve resilience to floods
- Increase resilience towards droughts and water scarcity

Our B-WaterSmart contribution

The RE-ACTOR tool developed in B-WaterSmart allows users to assess the environmental and economic impacts of upgrading scenarios with different technologies and prioritize them. The tool supports pre-screening general assessment on different scenarios for a later deeper assessment.

5 Engaging citizens and actors across sectors in continuous co-learning and innovation

There is a perpetuated process of monitoring, evaluation and learning of water-smart practices amongst all relevant sectors (industry, agriculture, environment) by deliberately engaging citizens in planning, decision-making and implementation. Such an integrated, knowledge-based, and inclusive approach can ensure the awareness and capacity required to transform towards a water-smart society.

What do we need to do in particular?

- Engage actors across sectors towards water-smartness and sustainability in the territory
- Engage citizens towards water-smartness and sustainability in the territory
- Provide transparent and clear communication from all actors via easily accessible channels and communication tools to citizens
- Create awareness by using digital tools (e.g. social media, games)
- Provide information on the reasons behind actions taken in relation to water and sustainability

Our B-WaterSmart contribution

Stakeholders from Alicante have been included in the project work through the Community of Practice and training actions. Social acceptance considerations, drivers, and barriers at the local/regional level have been identified through interviews with experts and stakeholders, leading to policy recommendations at regional and national levels. The Innovation Agency of Valencia (AVI) approved a grant to Aguas de Alicante in July 2023 for the "Urban Water Sandbox in Alicante" project, which will support the continuation of the Living Lab activities for the sustainability of the water cycle with the involvement of technological and administration stakeholders in the period 2023-2026. A general dissemination event was held in 2023 at the WWTP of Rincón de León, with the collaboration of the Consumer's Association of Alicante.

Our Achievements

360	m^3 of reclaimed water produced by the brine valorization treatment train
1	Microturbine was installed in the vortex flow of water effluents in Monte Orgegia WWTP

70,000 – 300,000 €/year	Potential cost of energy savings by doubling biogas and energy production from co-digestion based on the results of the pilot
560 m^3 NaClO/year	Potential annual production of hypochlorite sodium (NaClO) to be used for water disinfection and reuse
41.5%	Ammonia recovery from sludge dehydration drained water

Our Next Steps

The technologies tested in Living Lab Alicante have proved their positive impact on the availability of resources (reclaimed water, energy, added-value byproducts) and are also expected for nutrient recovery solutions. Aguas de Alicante has decided to upscale the co-digestion pilot to full scale, moving forward in collaboration with the industry waste providers that have taken part in the Living Lab pilot. The ammonia produced by the CEVAP technology could either be purchased by local fertiliser producers or used for NOx abatement in the cement industry, with which Aguas de Alicante already has synergies. Both options are being explored with potential end users, and the use for NOx abatement seems particularly promising. Furthermore, a LIFE proposal (LIFE MERLIN) aimed at further enhancing biogas production in co-digestion at the WWTP of Aguas Municipalizadas de Alicante, Empresa Mixta, based on the results of B-WaterSmart, has been recently approved.

In addition, the Innovation Agency of Valencia (AVI) approved a grant to Aguas de Alicante in July 2023 for the "Urban Water Sandbox in Alicante" project, which will support the continuation of the Living Lab activities for the sustainability of the water cycle with the involvement of technological and administration stakeholders in the period 2023-2026.

Aguas de Alicante performed a preliminary assessment for the application of Alicante to ENoLL. Although the assessment found that LL Alicante has a good focus on users and reality, there is room for improvement, particularly in terms of business models. Nevertheless, considering the requirements of the network, it was decided to put this process on hold, while prioritising the request for the inclusion of Alicante in the network of WOLLs instead, with the participation of the City Council and other relevant stakeholders. The procedure to become part of the WOLL network is currently under development, and it is expected to be fulfilled by the end of the year.

3.2 LL Bodø

3.2.1 Development

The results of the four Community of Practice meetings Bodø were used to develop the Strategic Agenda for the LL. The 1st Community of Practice meeting was held at KRAFT on 29 March 2022, the 2nd Community of Practice meeting was held as well at KRAFT on 28-29 September 2022, while the 3rd Community of Practice meeting was held at Bodø kommune Rådhus on 10 March 2023. The 4th Community of Practice meeting on 14 June 2024 was held at Bodø kommune Rådhus as well.

At the 1st Community of Practice meeting, the strategic plan for climate adaptation in Bodø was addressed and sustainable solutions for managing surface water were explored. By bringing together the various members of the Bodø community, the meeting aimed to promote a holistic and collaborative approach to addressing the challenges posed by climate change. The aim of the 2nd Community of Practice was to motivate and inspire stakeholders regarding nature-based solutions and to get input to the Strategic Agenda. This was important for the development of multifunctional outdoor spaces to develop a more robust urban development. The focus of the 3rd Community of Practice on a sludge to energy feasibility study being performed by SINTEF. A selection of the best method for energy production from sludge was discussed for Bodø. This CoP primarily focused on the strategic objectives of boosting value creation around water and engaging actors across sectors in continuous co-learning and innovation of the Strategic Agenda. The 4th Community of Practice focused on surface water management in municipal building approvals. In addition, feedback on the work completed in the last years was collected to optimize, simplify and clarify the process and structure promoting a change towards resilient infrastructure.

3.2.2 Strategic Agenda

What it’s about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry more towards a circular economy. The findings from the Bodø Community of Practice are summarised in this strategic agenda. The joint planning shows ways in which the region can become "water-smart”.

Our Vision

A strategic vision has been defined for LL Bodø, which is to serve as a guideline for all stakeholders involved:

"The LL Bodø vision is to become a sustainable, low-emission society and develop the city's resilience to climate change."

Our Strategic Objectives

Together with the Community of Practice stakeholders, five strategic objectives have been identified for the realisation of the strategic vision, as illustrated in Figure 3, which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

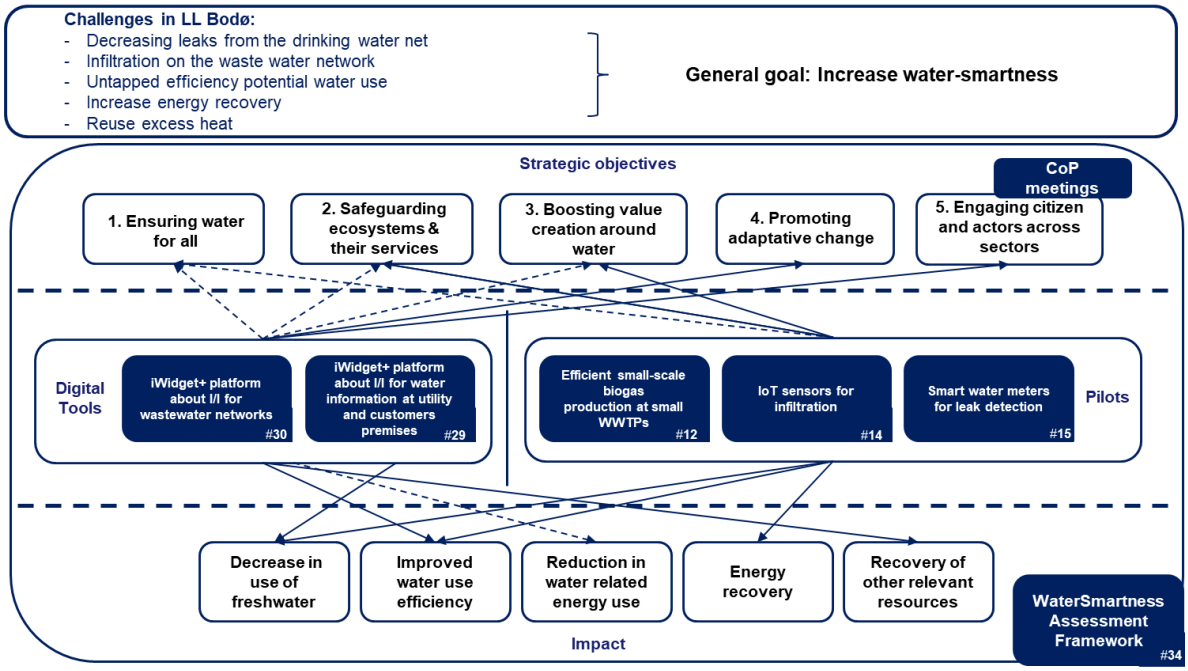

Figure 3: LL Bodø in a nutshell

1 Ensuring water for all relevant uses

All sectors (domestic, industrial, agriculture, environment) should have access to enough and sufficient water in terms of quantity, and safe water in terms of quality now and in the future. Ensuring water for all relevant uses describes the ability that now and in the future all sectors (domestic, industry, agriculture, environment) should be able to have secure and affordable access to sufficient water in terms of quantity

and to safe water in terms of quality for the required potable or non-potable purposes.

What do we need to do in particular?

- Develop sustainable cost-efficient water supply systems
- Implement relevant output from B-WaterSmart into the Masterplan for Bodø municipality (2026-2030)
- Include the UN goals for sustainable development into the municipality's masterplan (2022-2026) (Completed)
- Smart city project, how to make the city better for people and better for the environment

Our B-WaterSmart contribution

In B-WaterSmart sewer flow meters installed in the smart water meter pilot area were paired with municipal water meter data and utilized for the development of the Environmental Dashboard and additional studies. The Environmental Dashboard is a dashboard displaying water consumption habits on a municipal level through water zones. The additionally developed Nessie platform is a dashboard displaying water consumption habits on a homeowner level. The Environmental Dashboard provides a quick and effective method to calculate and verify leakage rates on a daily, weekly, or monthly basis. This is particularly crucial in Bodø where water meters are not mandatory, and current leakage estimates rely on costs and consumption estimates. The Smart Water Meters allow Bodø kommune to see the true water consumption habits of inhabitants. They are self-powered water meters equipped with flow, pressure, temperature, and battery sensors that send out data when in use.

2 Safeguarding ecosystems and their services to society

Water-related ecosystems provide multiple benefits and services to society and are essential for reaching several SDGs. Water-related ecosystems have significant economic, cultural, aesthetic, recreational and educational value. They help to sustain the global hydrological cycle, carbon cycle and nutrient cycles. They support water security, they provide natural freshwater, regulate flows and extreme conditions, purify water, and replenish groundwaters. Safeguarding ecosystems and their services to society describes the ability to prevent deterioration and ensure protection of water-related ecosystems, to enhance ecosystem services in urban and rural areas and to take carbon neutrality actions and promote resource efficiency in view of environmental protection.

What do we need to do in particular?

- Make a new plan for surface water which is focused on blue-green infrastructure (2021) (Completed)

  Better separation of wastewater and surface water. The revision of the master plan for wastewater has begun. New plan will be completed in 2024 and will apply for the period 2024-2030

- Create a plan for the possibilities regarding re-opening rivers and streams (2024)
- Create a plan for the investments needed for the EU's revised Urban Wastewater Treatment Directive (2024-2026)
- Work in the UN goals for sustainable development into the municipality's masterplan (2022-2026) (Completed)
- Implement relevant output from B-WaterSmart INALL Strategic Plan into the Masterplan for Bodø municipality (2026-2030)

Our B-WaterSmart contribution

The municipal staff of Bodø kommune has been educated and inspired through the Community of Practice meetings. As a result, they now support the implementation of the first Surface Water Plan and a feasibility study of a large blue-green structure in the new city development area. They also show interest in biogas production because of the B-WaterSmart sludge feasibility study.

3 Boosting value creation around water

The value creation from synergies in the water-energy-resources-waste nexus through the implementation of circular economy policies and business models supports a transformation to a water-smart society.

What do we need to do in particular?

- Recover energy from wastewater

Our B-WaterSmart contribution

B-WaterSmart contributed to the strategic goal with a study of alternative methods for handling the remaining biowaste post biogas production from sewage sludge.

4 Promoting adaptative change towards resilient infrastructure

The existence of governance, financial and decision-making conditions promotes adaptive change towards resilient infrastructure and enables robust planning and its implementation while assessing the effectiveness in terms of resilience.

What do we need to do specifically?

- Mapping of critical points in the sewage network and areas that give us problems today (2023) (On-going task)
- Risk assessments in priority areas (2023) (On-going task)
- Measures needed for priority areas and proposal for measures (2023-2024)
- Report to Norwegian Authority for Waterways (NVE) of critical points and areas in Bodø (2023)
- Continue mapping floodways and prioritise areas for measures so that we secure areas and buildings

Our B-WaterSmart contribution

Areas within the water sector lacking critical monitoring data were identified through the INALL assessment in B-WaterSmart. This helps the municipality to prioritize investments through awareness. Valuable perspectives on how building developers perceive and interpret the blue-green factor legislation were gained through interviews with stakeholders. This information is critical as the blue-green factor legislation has been implemented for the first time in northern Norway and needs to fit the local requirements.

5 Engaging citizens and actors across sectors in continuous co-learning and innovation

There is a perpetuated process of monitoring, evaluation and learning of water-smart practices amongst all relevant sectors (industry, agriculture, environment) by deliberately engaging citizens in planning, decision-making and implementation. Such an integrated, knowledge-based, and inclusive approach can ensure the awareness and capacity required to transform towards a water-smart society.

What do we need to do in particular?

- Continue casual cooperation with actors and schools in Bodø
- Continue collaboration with industry through existing arenas and events

Our B-WaterSmart contribution

B-WaterSmart has raised awareness about challenges and solutions related to domestic water demand, leakage detection, localization algorithms, data protection, and managing large data volumes. This has been achieved through training events and directly engaging in the development of tools and technologies. The local water industry, students, and household owners have benefited from this increased awareness. Through direct interaction between the water and waste department and

the public, awareness was also raised of the secondary costs associated with water systems.

Our Achievements

- Knowledge building on local surface water challenges and nature-based solutions with local stakeholders involved in early city development planning. This allowed the implementation of new legalisation, strategies, studies, and collaborative opportunities to take form throughout the project.
- Advancements in leakage detection technologies, by identifying leaks more accurately and quickly, these methods help conserve water resources, reduce water loss, and minimize infrastructure damage. This leads to cost savings for municipalities and water operators and ensures a more sustainable and reliable water supply for communities.
- Enhanced Smart Water Meter Technology represent a leap in efficiency and functionality. By enabling substantial data logging, leak detection, and two-way communication with the server, these meters provide water usage information, potentially saving both water and money for homeowners, municipalities, and water operators.
- Mapping and Monitoring Infiltration: Tracking sewer flow over an extended period with high temporal precision reveals issues such as illicit connections and improper stormwater pipe installations. By addressing these problems, the project contributes to improving wastewater systems' overall health and efficiency. Detecting and rectifying these issues can prevent pollution, mitigate flooding risks, and protect public health, ensuring a safer and cleaner environment for communities.
- Operational Monitoring and Data Accessibility: Detailed data collection and accessibility through the Environmental Dashboard’s and the Nessie System’s APIs enable better decision-making in water and wastewater infrastructure projects and for homeowners’ personal use. By providing insights into usage patterns, system performance, and higher leakage areas with increased need for improvement, this data facilitates more efficient resource allocation, infrastructure planning, and maintenance scheduling.

Our Next Steps

The B-WaterSmart project has selected tools and technologies that cater to the local environment's needs. The Bodø Living Lab's ambitions for the project include testing technology to achieve improved water use efficiency, raising awareness of water

usage habits among homeowners, developing technologies that assist homeowners and municipalities in leakage detection, inspiring and educating stakeholders regarding the use of blue-green structures, and assisting the development of a sludge biogas reactor for energy recovery from sludge. The ambitions beyond the project are to develop a plan for the new district using blue-green infrastructure with no non-potable use of drinking water and to continue its work with the implementation of a biogas reactor.

LL Bodø is founded on the goals, challenges, and strategic objectives outlined in various municipal plans, with a strong emphasis on digitalization and innovation to achieve ambitious climate and sustainability targets. Currently, LL Bodø operates on a project-based model and is in the process of optimizing the selection, utilization, and implementation of EU projects to ensure ongoing value for the municipality.

As LL Bodø nears the completion of its first Horizon 2020 projects, we will reflect on the insights gained over the past five years. These learnings will inform our approach to future projects, helping us to identify effective strategies and avoid past pitfalls. These experiences enable us to make informed decisions on how to move forward with upcoming initiatives, ensuring that LL Bodø continues to contribute meaningfully to the municipality's goals.

Taking this time to reflect on our approach is part of the reason LL Bodø is not interested in joining WOLL or ENoLL at this moment. However, this may change in the future as our strategy evolves. The results of the ENoLL self-assessment of LL Bodø show that there are great prerequisites, especially in the dimensions openness and users & reality, however no human resources are available at the moment.

3.3 LL East Frisia

3.3.1 Development

The results of the 1st Community of Practice meeting on 11 November 2021 (online), the 2nd Community of Practice meeting on 25 May 2022 at the DMK site in Edewecht, the 3rd Community of Practice meeting at the OOWV water treatment plant in Holdorf, the 4th Community of Practice meeting on 15 May 2023 at the OOWV water treatment plant in Nethen and the 5th Community of Practice meeting on 12 June 2024 at the OOWV drinking water and wastewater centre in Oldenburg were used to develop the strategic agenda for East Frisia.

At the 1st Community of Practice meeting, whiteboards and group discussions were used to develop the water-smart vision for the future of East Frisia. For the 2nd Community of Practice meeting an interactive workshop format was chosen. The participants discussed in two groups (district of Ammerland and district of Vechta) the five strategic goals of the B WaterSmart project, which form the framework for a water-smart future and are also reflected in the definition of water smartness. The 3rd Community of Practice focused on the discussion on the latest draft of the Strategic Agenda as well as presenting and discussing initial results of B-WaterSmart. The first results of regional assessment were discussed in the 4th Community of Practice. In the 5th and final Community of Practice the Strategic Agenda was discussed and finalized with all stakeholders.

3.3.2 Strategic Agenda

What it’s about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry more towards a circular economy.

The findings from the Community of Practice in East Frisia are summarised in this strategic agenda. The joint planning shows ways in which the region can become "water smart" by 2050. WE - these are the participants in the Community of Practice: Agrar- und Ernährungsforum Nordwest e.V. (AEF), Deutsches Milchkontor (DMK), Niedersächsisches Landesamt für Verbraucherschutz und Lebensmittelsicherheit (LAVES), Landkreis Ammerland, Landkreis Vechta, Oldenburgisch-Ostfriesischer Wasserverband (OOWV), Universität Vechta - Verbund Transformationsforschung agrar Niedersachsen (trafo:agrar).

Our Vision for 2050

A strategic vision has been defined for East Frisia, which is to serve as a guideline for all stakeholders involved:

*"A key element of the long-term vision for East Frisia is the **sustainable management of existing water resources**. Water is available to all stakeholders in the region (agriculture, ecosystems, industry, population) in the **required quantity and quality**.*

*In order to guarantee this in the long term, it has become increasingly important to tap into **alternative resources** in addition to the currently utilised groundwater resources. **Innovative technologies** are being used to pave the way for a **flexible and mobile water infrastructure** that combines centralised and decentralised infrastructure elements and enables the greatest possible adaptability with regard to future challenges in the region (e.g. climate change, demographic change).*

*Thanks to the **strong cooperation between local stakeholders** from agriculture, industry, politics, science, society and water sector, **new organisational and financing solutions for water-smart technologies** have been jointly developed and implemented."*

Our Strategic Objectives

Together with the Community of Practice stakeholders, five strategic objectives have been formulated for the realisation of the strategic vision, as illustrated in Figure 4,

which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

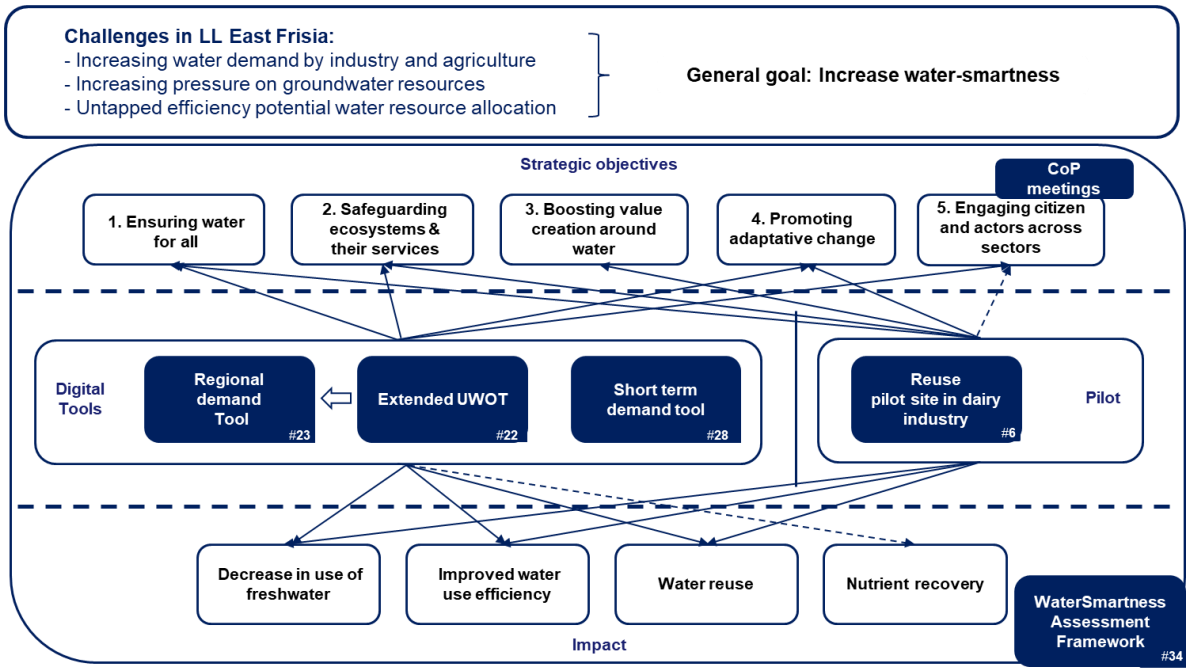

Figure 4: LL East Frisia in a nutshell

1 Ensuring water for all relevant uses

Everyone who needs water will get water – even in 2050 and beyond. Ensuring water supply for all relevant uses is important for the region for human rights reasons (water is life), but also for economic reasons (water as a location factor). There must be consensus on who pays for water use, who regulates it, and which applications are considered relevant. To achieve the goal, the basic information (figures, data, facts) must be available, e.g. on the quantity and quality of water resources in the region and the water requirements and utilisation purposes of water users. One building block to provide this basic information is continuous and predictive monitoring. Furthermore, flexible structures are needed to increase the effectiveness of the water supply (utilisation of the entire water cycle, minimising water losses, integrating alternative water resources, etc.). The entire water cycle and various water resources (such as process water, wastewater, or rainwater) should be activated in the future. The high quality of the water provided must always be ensured. In 2050, urban planning according to the sponge city principle and effective rainwater retention will be standard practice.

What do we need to do in particular?

- Implementing local, regional, and inter-regional water supply concepts
- Continuous collection of data on water demand, resources, and the water cycle
- Identification of potential water savings and its realisation
- Development of lighthouse projects that help to utilise the entire water cycle and a variety of water resources
- Making structures more flexible (e.g. decentralised supply concepts, provision of fit-for-purpose water, decentralised and mobile systems, rainwater harvesting)
- Implementation of rainwater management concepts

Our B-WaterSmart contribution

As part of B-WaterSmart, a holistic evaluation scheme was developed that can be used to support strategic planning and measure success in achieving long-term objectives towards a water-smart society. The evaluation approach is objective-orientated and consists of five strategic objectives, fifteen assessment criteria and sixty indicators. These were developed by the users (e.g. local and regional strategic decision makers, but also European and national authorities and research organisations) to develop tailor-made assessments. The assessment framework was integrated into a browser-based dashboard, which visualises the status quo of target achievement and also offers the opportunity to develop strategies for achieving long-term targets. The dashboard application was used to analyse where the LL East Frisia currently stands, and which strategies can help the region on its way to a water-smart society.

2 Safeguarding ecosystems and their services to society

The preservation of groundwater bodies secures the basis of our lives. Even in 2050, groundwater recharge is guaranteed in the region and water is managed sustainably. In this process, ecosystems and their ecosystem services form our economic backbone. Water is the connecting factor between ecosystems (peatlands, groundwater, surface water, forest, land). The various ecosystems are used efficiently and sustainably in order to better compensate for the consequences of climate change (e.g. heavy rainfall, drought). Land sealing is reduced, the local water balance strengthened, and regional availability is thus promoted.

Sustainable irrigation and drainage of the agricultural landscape is achieved, among other things, through efficient irrigation and intelligent management of drainage

systems. A solid data base, including the number and volume of private wells, is the basis for conserving ecosystems and their services.

What do we need to do in particular?

- Consistent political advocacy of the need to compensate for diffuse inputs into water bodies (producer responsibility)
- Further development of effective measures to protect and monitor water resources
- Support developments to improve surface water quality, e.g. definition of quality objectives, knowledge of surface water quality
- Supporting groundwater recharge through infiltration and surface unsealing
- Developing efficient and water-saving irrigation and intelligent drainage management

Our B-WaterSmart contribution

The Regional Demand Allocation Tool developed in the B-WaterSmart project is a GIS application for visualising and processing open-source information on natural water availability and sectoral consumption. The tool can be used to identify i) potential consumption centres and areas of water scarcity, ii) alternative water resources or areas with available water sources and iii) water outflow from one region to another. Based on the analysis, the impact of alternative water availability scenarios on water demand can be visualised.

3 Boosting value creation around water

In 2050, East Frisia is future proof as a water region. The increase in value creation in the water sector has created new jobs and increased efficiency through cooperation. Local water cycles, including the reuse of raw materials contained in sewage sludge, have been identified and closed. The local water cycle is closed through new products and technologies, such as green roofs, percolating paving stones and other ecological construction methods. The economic value of water is recognised and reflected through water pricing and appropriately supported through smart metering. Wastewater is regarded as a resource and used in a variety of ways. Substances, such as phosphorus, and energy are recovered from wastewater and, where possible, utilised regionally. Industrial reuse of process water is also common practice. In particular, the separation of household-related wastewater has been introduced for this purpose.

What do we need to do in particular?

- Initiation of projects to utilise alternative water resources for non-potable fit-for-purpose water applications (including rainwater utilization and infiltration measures)
- Development of resilience criteria for the management of water reuse measures
- Development and implementation of customised / flexible water supply solutions
- Creation of new jobs and business models along the water value chain
- Strengthening cooperation between regional stakeholders, for example through round tables or networks to be established
- Enabling start-up financing and incentive mechanisms for the use of alternative water resources and rainwater management in the private and commercial sectors

Our B-WaterSmart contribution

As part of the B-WaterSmart project, a pilot plant was built at the DMK dairy company site in Edewecht to reuse the whey vapour condensate (= cow water) produced there. During the milk processing procedure, large quantities of cow water are produced through its concentration by means of evaporation and membrane filtration. Despite the consistently good quality of the separated water flow, it is not fully utilised, as a quality similar to drinking water is required for uses where water comes into contact with food. By combining biological treatment with the use of ultrafiltration and reverse osmosis in the pilot plant, the vapour condensate could be transferred into high quality water, comparable to the local drinking water (see Figure 5). The official authorisation of a large-scale plant of this type and the use of the cow water for non-restricted reuse in the cheese production process is currently being aimed for.

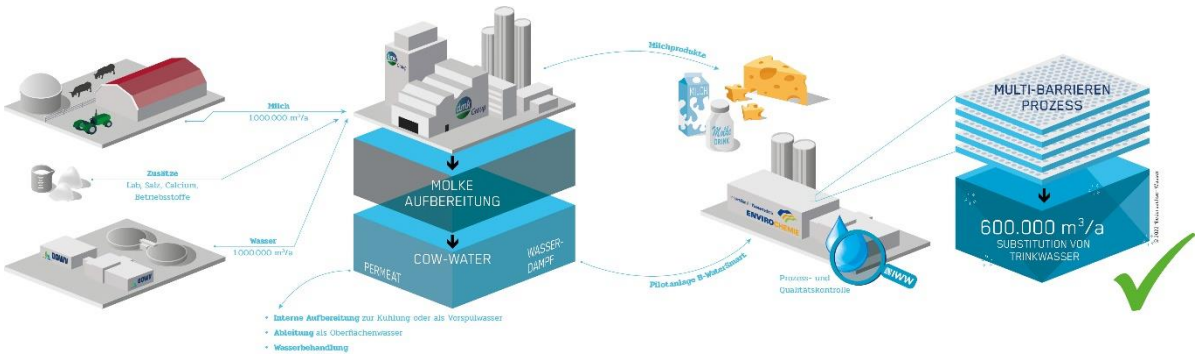

Figure 5: Pilot Plant in Edewecht

4 Promoting adaptative change towards resilient infrastructure

In order to adapt the existing infrastructure to the future challenges posed by climate change and demographic change, suitable tools are needed to determine the basic water demand, but also to forecast extreme events. Based on a significant data pool, collected by means of digital meters and measuring instruments, the individual infrastructure components (e.g. local reservoirs and industrial storage facilities) are networked by means of intelligent control and visualisation tools (e.g. digital twins). Collaborative infrastructure planning is practised by all actors in the region.

What do we need to do in particular?

- Initiation of projects to develop a flexible and mobile water infrastructure (e.g. decentralised supply concepts)
- Use of digitalisation for the (remote) inspection of critical infrastructure
- Development of digital tools to predict extreme events and support the adaptation of infrastructure

Our B-WaterSmart contribution

As part of the B-WaterSmart project, flow measurement probes were installed in the drinking water pipes in three pilot areas within the city of Lohne (see Figure 6). By combining neighbourhood-based drinking water consumption data, weather information and socio-economic characteristics of the areas, the Short-Term Demand Forecasting Tool aims to achieve a better understanding of drinking water consumption groups. This will create the basis for short-term, spatially differentiated and user group-specific water demand forecasts and optimise the demand-based management of waterworks and water storage facilities. Together with other measures such as the construction of a booster pump station, new water supply pipes and a new drinking water reservoir, the aim is to reduce pressure drops in the drinking water network for the city of Lohne, particularly during long periods of hot weather with high drinking water demand.

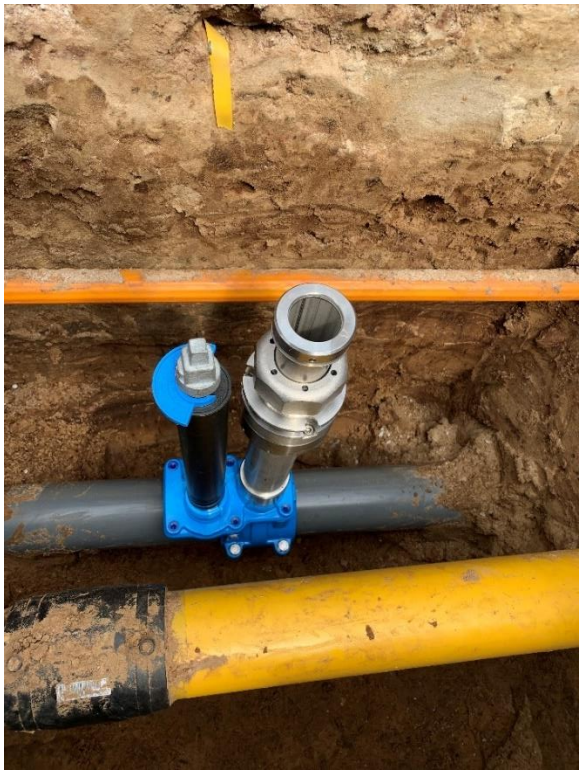

Figure 6: Flow Measurement Probes in Lohne

5 Engaging citizens and actors across sectors in continuous co-learning and innovation

In 2050, there is social and cross-sectoral consensus around water in the region. Awareness on water-smart issues is present across all age groups and is promoted through further education and water-specific educational institutions. Education on water and “water smartness” is already being carried out in schools. The conditions for citizen and stakeholder participation in the region have been created and are widely used. By raising awareness and directly involving stakeholders in decision-making processes, the willingness to reach consensus and compromise is fundamentally present in society and is further strengthened by legal regulations and a sound technical basis to support decision-making.

What do we need to do in particular?

- Increased exchange and transfer of knowledge on water management topics across sectors
- Targeted communication with citizens on the use of water as a resource
- Increased number of water-specific educational institutions and formats

- Realisation of cooperation projects

Our B-WaterSmart contribution

As part of the B-WaterSmart, information events were held on the topic of "Water Smartness" (see Figure 7). In addition to the presentation of project results, the focus was also on how everyone can take responsibility for ensuring that water is available in sufficient quality and quantity for future generations.

Figure 7: Community of Practice Meeting at DMK Edewecht

Our Achievements

600,000	m^3 of drinking water could be substituted by a large-scale version of the B-WaterSmart pilot plant
5	flow meters were installed in the drinking water network in Lohne
25	Participants have been actively involved in the Communities of Practice meetings for East Frisia
12,000	Visitors to the “Woche der Umwelt” organised by the German Federal Environmental Foundation had the opportunity to find out more about the water-saving solutions developed in B-WaterSmart
1,600,000	m^3 of drinking water are to be replaced by treated process water in the OOWV association area by the end of 2026. The aim is to

establish and apply standardised methods for water-saving solutions.

Our Next Steps

Industriewasserversorgungsgesellschaft Nordwest-Niedersachsen GmbH (IWAG)

IWAG - a subsidiary of OOWV - is currently being reorganised in order to develop and implement resilient water supply concepts for industry. As part of an integrated water resource management, IWAG will examine all available resources (e.g. surface water, municipal and industrial wastewater, seawater) and secure the industrial water supply without competing with the central drinking water supply.

Strategierat Wasser Weser-Ems

In 2023, the German national water strategy was adopted. Subsequently, federal states such as Lower Saxony developed water supply concepts. Following these developments, relevant stakeholders of the water cycle in the region decided to bundle their efforts. With the establishment of the Strategierat Wasser Weser-Ems in September 2023, the key players in the region's water sector have joined in one committee (Figure 8). The aim is to ensure the sustainable use of our water resources in the Weser-Ems region and to establish regional, climate-resilient water management. The results of research projects such as B-WaterSmart can make an important contribution to this.

Figure 8: 2nd meeting of Strategierat Wasser Weser-Ems on 22 February 2024 in the Wesermarsch district hall.

Further research projects

In order to identify and develop new solutions for a water-efficient society, new research projects on alternative water resources and the optimisation of process concepts have been initiated.

In the Developers of Circular Solutions (DECISO) project, which supports European cities and regions in the development of financing systems for circular economy initiatives, options for rainwater utilisation are being considered in the OOWV supply area.

In order to develop innovative and feasible processes for recycling filter rinsing water and utilising filter sludge, the FITWAS project is investigating membrane processes with different process concepts and membrane modules/materials in comparison to conventional treatment (e.g. sand filtration) and disposal, starting with laboratory tests and ending with practical tests at four water treatment plants.

As part of the IWM-H2 project "Integral water management for hydrogen production - development of guidelines for energy industry planning and authorisation procedures", a wide variety of water resources are being examined for the Wilhelmshaven case study region and the district of Friesland with regard to their availability, technical and economic usability and suitability for approval for hydrogen production.

Application Water-Oriented Living Labs (WOLL) and European Network of Living Labs (ENoLL)

Recent developments have highlighted that water availability is becoming an increasingly critical factor for the viability of locations in northern Germany. In response, various initiatives and projects have been launched to discover innovative methods of managing water resources in the region. Research projects play a crucial role in these efforts. Currently, we have decided not to apply as a WOLL due to our strong thematic and regional focus, which we implement through specifically selected research projects. However, we are considering a WOLL application in the future. This situation also explains why Living Lab East Frisia is not applying to become part of the ENoLL. Additionally, our self-assessment results indicate that we do not yet meet the ENoLL criteria. While the governance and operations criteria are in line with ENoLL standards, in particular equipment & infrastructure and human resources would need to be improved.

3.4 LL Flanders

3.4.1 Development

The results of the four Community of Practice meetings in Flanders were used to develop the Strategic Agenda for the LL. The 1st Community of Practice meeting was held on 17 February 2022 (online), the 2nd Community of Practice meeting was held at Waterproductiecentrum De Blankaart (De Watergroep) on 18 October 2022, while the 3rd Community of Practice meeting was held Dorpshuis Hombeek in Mechelen on 23 November 2023. The 4th and final Community of Practice meeting was held on 6 June 2024 in Mechelen as part of a broader final conference of LL Flanders (organised with Water Europe).

In the 1st Community of Practice stakeholders were informed about the Strategic Agenda approach for a long-term vision for water smartness in the region. During the meeting, the purpose of the Strategic Agenda was discussed as well as four key strategic objectives for LL Flanders. For each of the four objectives, participants discussed a specific statement.

Building on the 1st Community of Practice meeting, participants discussed in the 2nd Community of Practice two main topics. The first was decoupling of the human water system (households: “humane waterketen”) and the water system. Participants discussed the principle of a closed water system and the technology & infrastructure, business models, knowledge & skills, and institutional rules needs to realise a closed water system by 2050 and beyond. The second topic was the reuse of wastewater treatment plant effluent. Given the current water situation in Flanders (dry summers resulting in low groundwater levels), participants discussed the potential for and barriers (technical, economic, socio-political) to effluent reuse for multiple applications (e.g., irrigation water, process water, cleaning water, groundwater recharge, drinking water, surface water replenishment, toilet flushing, etc.). Together, participants explored the thresholds and most promising applications of effluent reuse. To realise the ambition of Flanders to scale-up circular and smart water use, a prioritisation for the application of effluent reuse is urgently needed, to contribute to water saving and efficient water use.

The 3rd Community of Practice focused on the discussion on how to build a sustainable future for the case in Mechelen (stormwater reuse) and exploring innovative business and governance models for stormwater management. To do so, participants suggested a variety of funding approaches involving different stakeholders and defined the way forward to practice after the end of B-WaterSmart.

Objective of the 4th and final meeting was to inform the participants about:

- What a water smart society and economy is and how it is connect to 1) Water Europe's Water Smart Vision and 2) Green deals priority 'transition to a circular economy' 3) and how B-WaterSmart contributed to this.
- Share the lessons learned from the two cases within LL Flanders
- Showcase what a Water-Oriented Living Lab can mean for Flanders and beyond. 1) Via a visit to WOLL Mechelen, 2) via a keynote from ENoLL

The meeting brought together a diverse group of stakeholders including knowledge institutes, drinking water companies, government representatives, technology suppliers, water industry, network organisations, financial institutions, etc. Participants also heard via a keynote from the work done in LL Alicante to address water scarcity challenges in the region.

3.4.2 Strategic Agenda

What it's about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry more towards a circular economy. The findings from the Flanders Community of Practice are summarised in this strategic agenda. The joint planning shows ways in which the region can become "water-smart".

Our Vision

A strategic vision has been defined for LL Flanders, which is to serve as a guideline for all stakeholders involved:

"The LL Flanders strategic agenda specifically looks towards mitigation of impacts on drinking water production, stormwater management and water as a sustainable resource for agriculture.

The LL Flanders vision is to become more water smart. This is achieved in B-WaterSmart through the application of alternative water resources (e.g., water reuse) and improving water use efficiency."

Our Strategic Objectives

Together with the stakeholders, the four strategic objectives are relevant for the

realisation of the strategic vision, as illustrated in Figure 9, which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

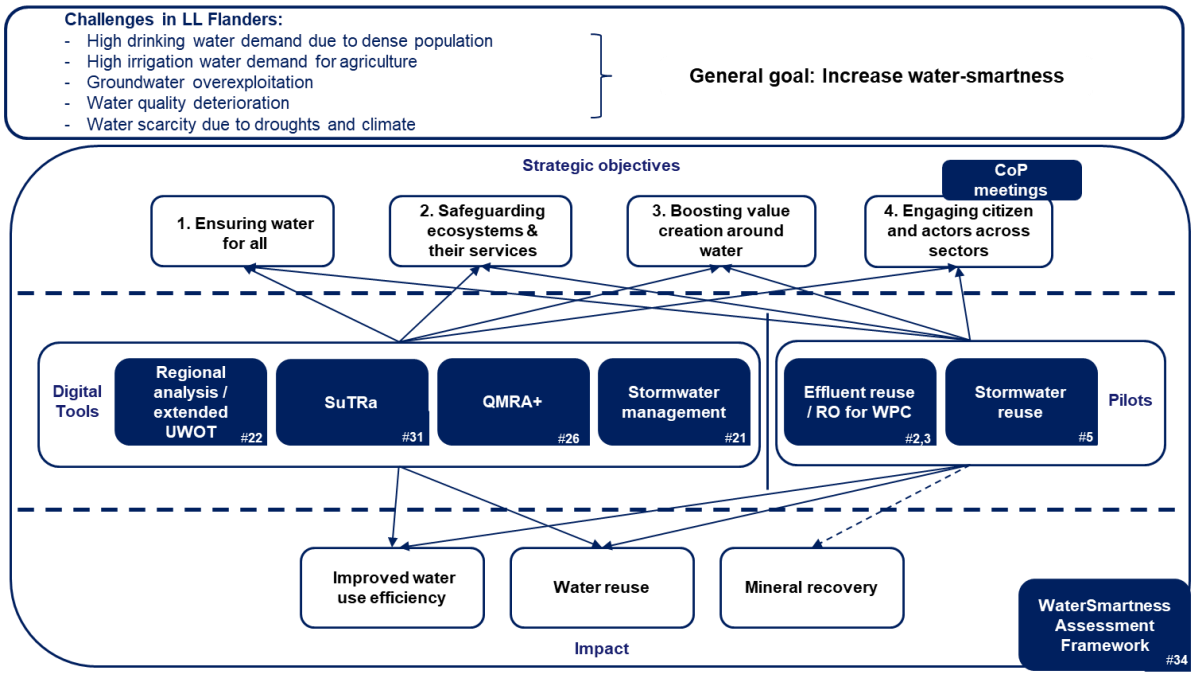

Figure 9: LL Flanders in a nutshell

1 Ensuring water for all relevant uses

Ensuring water for all is the basic condition that feeds into the other objectives. With increased pressure of climate change, ensuring the production capacity and robustness of drinking water supply, the efficient management of water, adequate risk assessment and monitoring approaches for quality and quantity compliance are essential. The main aspects are to provide water for all while safeguarding health.

What do we need to do in particular?

- Water for all
  - Expand production capacity and robustness of the drinking water supply
  - Implement smart systems to ensure efficient water management and water Conservation.
- Safeguarding health and safety
  - Develop risk assessment methods and online monitoring systems
  - Establish methods and governance models for quality assurance of

(decentralized) circular systems.

Our B-WaterSmart contribution

In B-WaterSmart water availability and demand (including potential alternative water sources) was modelled using the Urban Water Optioneering Tool (UWOT) to develop a strategy to increase water system robustness at the regional level and promote sustainable water supply solutions while considering environmental and societal aspects.

A critical success factor for water reuse is the assessment and control of microbial safety risks. The Quantitative Microbial Risk Assessment (QMRA+) tool was developed to support the design and assess the required treatment needed for water reuse. QMRA+ can be used to assess existing purification systems and to help determine the design requirements of purification systems (e.g. for alternative water sources) concerning microbial safety requirements. Within B-WaterSmart, QMRA+ was used to help design the effluent reuse demonstration system by back casting the required removal rate.

The demonstration activities in the B-WaterSmart project show a decrease in the use of freshwater resources at a local scale. Secondly, wastewater reuse and Closed-Circuit Reverse Osmosis (CCRO) improve water security when regional water demands remain at reasonable levels. However, the effectiveness of the measures is limited when regional demands become high (>30000 m^3/day). The results indicate that the most efficient way to secure the system against future stresses is to combine both, wastewater reuse and CCRO, without (over-)relying on one solution.

2 Safeguarding ecosystems and their services to society

Safeguarding the environment is essential to the sustainability of the region. Water management practices should implement water smart approaches to ensure resilience of water systems and drinking water production in regard to climate change, and to preserve the environment to manage risks (e.g., flooding, water scarcity, etc.) and promote groundwater replenishment and water retention.

What do we need to do in particular?

- ❖ Becoming resilient to climate change
    - Implement water smart systems to make water systems more resilient against droughts, floods and to support different other ecosystem services (e.g., drinking water production, food supply…)
    - Implement water-smart systems to make drinking water production

more resilient towards fluctuations in available sources of water due to climate change

- ❖ Conserving the environment
  - Reduce and compensate for impervious surfaces to allow for better infiltration to reduce flood risks, capture rainwater, and promote groundwater replenishment

Our B-WaterSmart contribution

In B-WaterSmart the smart stormwater management system is used to control the outflow from a buffer basin and the water distribution for irrigation. This is done to optimize the functioning of the basin for flood prevention and to ensure the availability of water for irrigation during dry periods. The retention basin in Hombeek (Mechelen) contributes strongly to the goal of flood-proofing the area, as it leads to runoff reduction rates that range from 22% - 94% (depending on the month of reference). This water can locally be used in agriculture and contribute to groundwater recharge, sparing and replenishing natural resources. The preliminary results also showed a potential availability of 25.000 m^3 of water for reuse (however this was during an exceptionally wet period and in practice not all this water will be used because of the already available water).

The capacity to produce drinking water in the region is increased without conflicts with other local water demands. The wastewater is actually discharged to surface water close to sea and has hardly any local water benefit. The CCRO technology enables to increase of the intake from the river IJzer in the reservoir during periods with abundant water availability. The additional water intake is mainly enabled outside drought periods and creates thus no conflict on the local water system during drought periods.

3 Boosting value creation around water

Demonstration cases and associated business models provide a lever for value creation around water. These can be implemented at larger scale and/or applied at other suitable locations in the region for further value creation.

What do we need to do in particular?

- ❖ Develop demonstration cases and associated business models in B-WaterSmart and related projects that can be implemented at larger scale and/or applied at other suitable locations in the region

Our B-WaterSmart contribution

During a meeting with the Flanders Environmental Agency (Vlaamse

Milieumaatschappji, VMM) about water reuse (among other things) the B-WaterSmart project was presented, with a focus on stormwater management in Mechelen. The government officials showed interest in upscaling the project's stormwater reuse concept to other basins in Flanders as well and making them multifunctional for the entire region. A lot of potential forms of governance and possible financing structures were determined during a dedicated Community of Practice meeting on the Mechelen case.

In parallel with other initiatives (Blue Future Limburg and Deeper Blue), the relevant data was provided for the risk assessment and monitoring that demonstrates the possibility of effluent reuse for drinking water production in compliance with the new drinking water regulation from January 2022. This new regulation specifies the potential use of alternative water resources to replace the conventional groundwater and surface water resources. The use of alternative water resources (as wastewater effluent) can be allowed based upon an extensive risk assessment and mitigation plan during design and operation.

4 Engaging citizens and actors across sectors in continuous co-learning and innovation

Collaboratively developing innovative governance systems centred on the value of water where knowledge, resources, impact, and responsibilities regarding water issues contribute to collaborative platforms and policy initiatives to set the agenda towards sustainable water management (water storage, infiltration, flood protection, etc.).

What do we need to do in particular?

- Developing innovative governance systems centred on the value of water

Our B-WaterSmart contribution

Through the Communities of Practice and citizen engagement during B-WaterSmart a few lessons were learned. Firstly, better awareness of water treatment costs improves the level of acceptance of the implementation of different treatment solutions. Secondly, the degree of social acceptance depends on the type of water being used but the behaviour of stakeholders changes positively when a solution is already being implemented. And last, cooperation and communication ensure good engagement of citizens, and everyone benefits from that.

Our Achievements

1. Full scale 1400 m³ buffer basin (with a smart stormwater reuse management system for subirrigation of 4 ha agricultural area). No uncontrolled overflows occurred in a testing period of 6 months, showcasing a successful combination of flood prevention and water storage.

2. Pilot demonstrations on alternative sources to improve regional (drinking) water supply using CCRO, and treating effluent using Ultrafiltration (UF), Reverse Osmosis (RO), active carbon and Ultraviolet (UV) treatment processes.

    - Stable operation of CCRO pilot at 95% water recovery with good retention of micropollutants
    - The combination of UF and RO reduces concentrations of chlorides and micropollutants below intake standards for the drinking production site of the Blankaart.

3. Tools developed including, UWOT [1], QMRA+ [2], SuTRa [3] (this tool was eventually not used in LL Flanders) and a stormwater reuse management system[4]

4. 177% of external organisations engaged in the Communities of Practice

Our Next Steps

The next step for LL Flanders is to go from inspiration to practice as discussed in the Communities of Practice. With respect to the buffer basin, there have been a variety of funding approaches discussed involving different stakeholders (e.g. farmers, industries, municipalities, and communities), including for example, traditional

[1] Modular simulation tool of the urban water cycle from source-to-treatment-to-tap, supporting planning and assessment of distributed interventions. The tool is used to design and simulate smart water systems at the neighbourhood, regional, or city scale.

[2] Expansion of AquaNes tool QMRA for drinking water, for application of water reuse and in agriculture. The tool enables users to estimate the microbial health risk of using various water sources, including reuse of wastewater.

[3] Python package to calculate the subsurface removal of microbial organisms over a distance and with time using an analytical approach. The aim is to allow for a quick assessment of subsurface removal of microbial organisms for a growing selection of species.

[4] System allowing the combination of operational management of a stormwater basin and a connected sub-irrigation system for groundwater recharge and direct irrigation; optimises system functioning, based on real time data and model predictions.

taxation models to innovative collaborations and sustainability-focused initiatives, to contributions, to cooperatives, to engagement with industries, or innovative partnerships (e.g., creating a multifunctional space around the basin for recreation or leisure). An appropriate business model for the buffer basin in Hombeek will need to be defined to ensure the long-term sustainability of the approach, and to explore potential replication to other parts of the Flanders.

In fact, the ambitions beyond the B-WaterSmart project are to use the experiences from the demonstration sites to identify the potential valorisation and replicability of the applied technologies at a larger scale at those locations and/or at other locations identified in the regional water system model. The assessment of the regional water system for Mechelen and De Watergroep will enable systemic innovation in the region and form the basis of a roadmap for systemic smart water management in Flanders in 2040. The long-term goal is to work towards a “water smart” region with innovative technologies, multi-stakeholder partnerships, and a stronger integration of water management in the region. Various follow-up projects are ongoing to further explore the results obtained during the B-WaterSmart project related to drinking water production.

- The projects Blue Future Limburg, Deeper Blue and Nathalie aim to demonstrate effluent reuse directly or in combination with aquifer recharge.
- At the Ganzepoot a new drinking water production centre will be built with surface water and/or seawater as raw water source. Among others CCRO will be considered.

The City of Mechelen applied as a Water-Oriented Living Lab (WOLL) with Water Europe within the Water4All partnership. Mechelen has been recognized as a WOLL and is now part of the Atlas and the Network of WOLLs in Pillar C of Water4All, demonstrating the effort of the city for a water-smart society beyond the buffer basin in Hombeek. During the final meeting, a walk and boat tour showed various innovates that the city is applying to address climate challenge from creating more space for water in the city centre, to infiltrating run-off water, to integrating blue-green designs for biodiversity, recreation, water quality and quantity. The City of Mechelen sees a clear added value in working within a Living Lab context that connects government, knowledge institutions, industry, and citizens to put Water Europe’s vision on the value of water into practice and in promoting systemic innovation with the ambition of achieving a water-smart society.

An ENoLL self-assessment has been performed with key input from the LL owners, namely De Watergroep and Proefstation voor de Groenteteelt.

- De Watergroep: Our LL was started in the framework of the B-WaterSmart project. We do not have the ambition to outlive this project with this LL, so the form is to a large extent not applicable, at least to De Watergroep. We have long lasting relations with some partners of our consortium, outside a LL framework. We tend to involve stakeholders in our solutions when appropriate, but large stakeholder involvement and co-creation is not always beneficial, nor efficient and therefore, we evaluate this project by project.
- Proefstation voor de Groenteteelt: It would be advisable to have a common understanding among the partners, stakeholders involved about what exactly a living lab is, and what it is not, at the start of the project. An external speaker, such as Koen Vervoort, who can bring info with knowledge on the subject is an added value. Nevertheless, we are looking at whether we can keep the Living Lab around urban sealing and water infiltration alive with the City of Mechelen.

The results of the ENoLL self-assessment show that LL Flanders is on a good way regarding users & reality as well as stability & scale-up. However, the strategy dimension does not meet the ENoLL criteria yet.

3.5 LL Lisbon

3.5.1 Development

The results of the five Lisbon Community of Practice meetings and the two Focus Group meetings were used to discuss and update the Strategic Agenda for the Lisbon LL. The pilot Community of Practice meeting (CoP #0) was held online on 7 July 2021, the second Community of Practice meeting (CoP #1) was held online on 9 March 2022, the third (CoP #2) was held at the Noble Room of the Lisbon University's Rectorateon on 26 April 2022, the fourth (CoP #3) was held at the Noble Room of the Lisbon University's Rectorate on 10 May 2023 and the final and fifth meeting (CoP #4) was held at the Institute of Social Sciences of the University of Lisbon (ICS-UL) on 22 May 2023. The 1st Focus Group meeting took place at the LNEC Congress Center on 19 January 2023, and the 2nd Focus Group meeting was held at the Institute of Social Sciences of the University of Lisbon (ICS-UL) on 15 June 2023.

In CoP #1, the key objective was to discuss the challenges for Lisbon region regarding the achievement of a water-smart society, as well as the potential for replicating the LL Lisbon solutions across the Metropolitan Area. In CoP #2, the vision of a water-smart city was introduced as well as strategy for achieving it and the solutions established in B-WaterSmart. Expectations and contributions of the key stakeholders towards a water-smart society through long-term engagement with the Community of Practice activities were discussed. CoP #3 was focused on the Lisbon Strategic Agenda towards a water-smart society. In particular, the four topics "water and climate resilience", "non-potable uses for treated wastewater", "information, communication, and awareness-raising" and "circular economy and building value for water" were discussed. In CoP #4, the focus was on the social acceptance of water-smart solutions, information and communication, governance models for a water circular economy, and evaluation and monitoring, all as key contributes to the Strategic Agenda of LL Lisbon. In the final CoP #5, the tools developed in the Lisbon Living Lab throughout the B-WaterSmart project (2020-2024) were presented, and the key results of the CoP meetings since 2021 were discussed. Importantly, the replication potential of the B-WaterSmart solutions were discussed with the follower municipalities and other stakeholders, the target group of CoP #0.

In the 1st Focus Group meeting, data and information availability and management were discussed with specific stakeholders involved in the decision-support tools developed within B-WaterSmart (technology providers) and in the management of urban areas (urban planners and municipality staff). In the 2nd Focus Group meeting, technical challenges related to implementing climate-ready certificates in buildings were addressed, with a sub-group of experts and stakeholders involved in the

buildings' sector (construction companies, architects, and engineers; other involved policymakers and regulators).

3.5.2 Strategic Agenda

What it's about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry and local administration more towards a circular economy. The findings from the Lisbon Community of Practice are summarised in this strategic agenda. The joint planning shows how Lisbon can become "water-smart".

Our Vision

A strategic vision has been defined for LL Lisbon, which is to serve as a guideline for all stakeholders involved:

"LL Lisbon's long-term vision is to be Water Smart according to the B-WaterSmart definition including the main concerns of the Lisbon municipality such as climate change resilience (water scarcity/heat waves and heat islands), safeguarding human health, inclusiveness, equity, transparent public management, and citizen engagement.

LL Lisbon's long-term vision is namely focused on water efficiency and water reuse towards a circular economy in Lisbon, in order to increase water smartness towards a circular economy, and ultimately acting as an accelerator to achieve sustainability and climate goals."

Our Strategic Objectives

Together with the Community of Practice stakeholders, five strategic objectives have been identified for the realisation of the strategic vision, as illustrated in Figure 10, which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

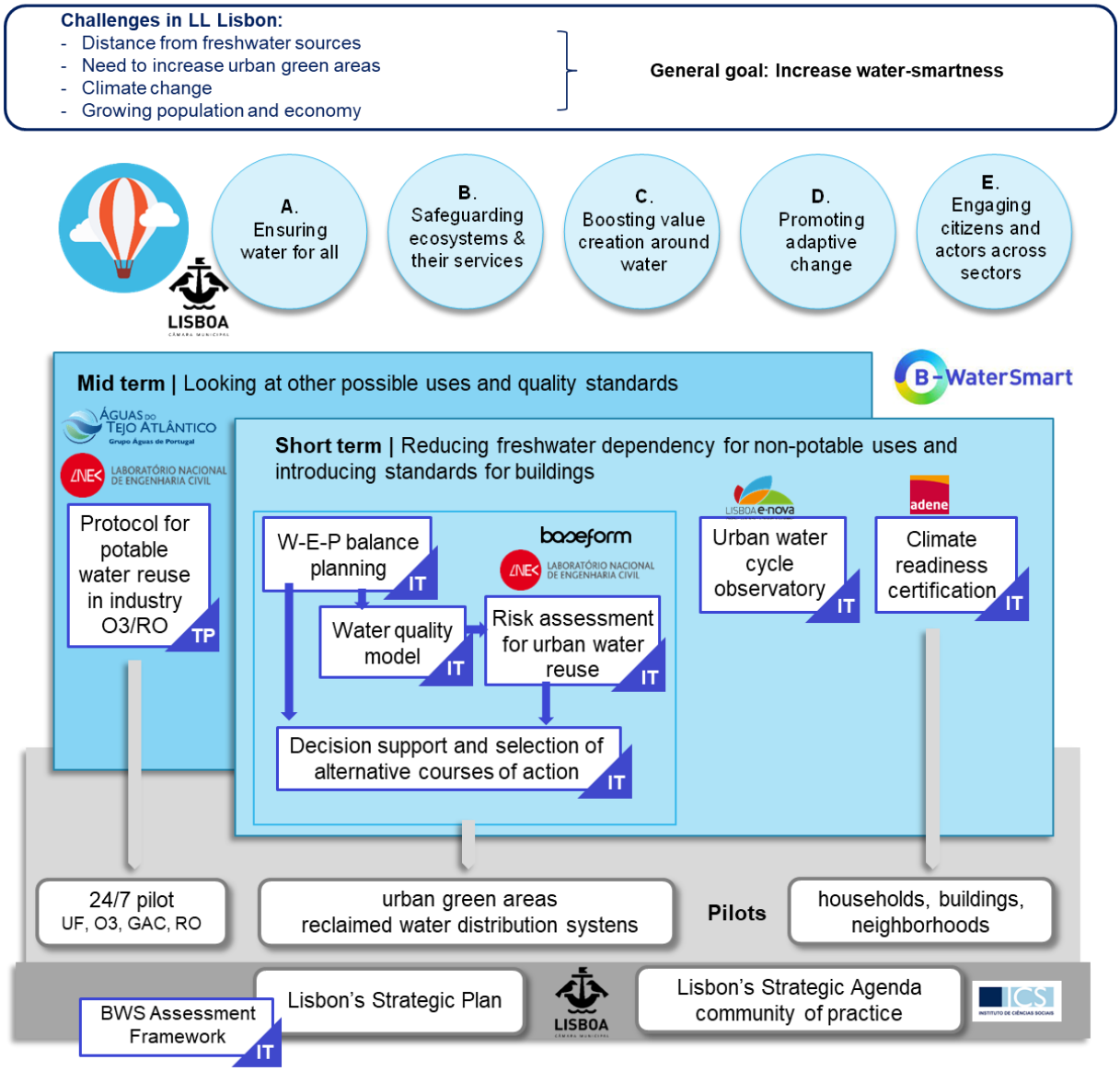

Figure 10: LL Lisbon in a nutshell

Our B-WaterSmart solutions in connection with the strategic objectives

To better identify the links between the water-smart applications for Lisbon and the B-WaterSmart strategic objectives, the following matrix is presented (s. Figure 11). A strong link is represented with an "X". When the link is less important, a smaller, lighter "x" is used.

Water-smart applications for Lisbon	Strategic Objectives (from WP6)				
Tools	SO.A	SO.B	SO.C	SO.D	SO.E
#1 Water reclamation protocol for potable water reuse in beverage industry	X		X	x	x
#17 Environment for decision support and selection of alternative courses of action	X	X	x	x	x
#20 Urban water cycle observatory		x			X
#24 Water quality model in the reclaimed water distribution network	x		X	X	
#25 W-E-P balance planning module	x	X	X	x	
#27 RA-Reuse: Risk Assessment for Urban Water Reuse module	x		X		
#33 Climate readiness certification tool				x	X

Figure 11: Links between the B-WaterSmart solutions and strategic objectives in LL Lisbon

A sequence of four applications for water-smart allocation was designed to jointly provide the ability to match water supply and demand while managing water volume, cost, energy, nutrients, and risk:

- Water-energy-phosphorous balance planning is a tool for formulating and assessing candidate combinations of two or more supplies, including reclaimed water, in satisfying non-potable water demands in urban or regional contexts, to enable prioritizing strategies and actions (tool #25).
- Urban water reuse risk assessment tool, a user-friendly risk assessment framework for water reuse in non-potable uses based on the relevant ISO standards and the European regulation on water reuse (tool #27).
- The reclaimed water distribution network water quality model is a tool that implements a new, innovative algorithm for modelling chlorine decay, as a function of key water quality parameters, on top of a standard hydraulic model; residual chlorine is a key barrier for risk management in reclaimed water distribution systems (tool #24).
- Environment for decision support and alternative course selection tool is an intuitive numerical and visual decisional environment that enables non-experts to easily understand the decisional problem, rank the candidate options, and ultimately make a decision based on factual evidence/data (tool #17).

Looking ahead at water reuse and resilience under increased water-scarcity, a pilot demo of reverse osmosis-based reclamation schemes allowed the development of a Water Reclamation Protocol for Safe Potable Water Reuse in the Beverage Industry (craft beer) (tool #1), and via the special events where this beer is offered, to build the public trust on safe water reuse.

The Urban Water Cycle Observatory (tool #20) was developed in B-WaterSmart for building awareness, engaging, and empowering citizens on smart-water use. This tool is a visualization instrument for monitoring and communicating performance, supporting urban planning and decision-making. It includes two types of approaches: top-down (city level, annual data, infographics) and bottom-up (single user level, smart metered data, data analysis).

The Climate Readiness Certification Scheme (tool #33) developed in B-WaterSmart for evaluating three dimensions (water efficiency, water-energy nexus, and climate adaptation) in a 3-scale analysis (household, building, and neighbourhood) and with three moments of certification (design phase, construction, and use) supports the assessment and development of urban areas.

1 Ensuring water for all relevant uses

All sectors (domestic, industrial, agriculture, environment) should have access to enough and sufficient water in terms of quantity, and safe water in terms of quality now and in the future. Ensuring water for all relevant uses describes the ability that now and in the future all sectors (domestic, industry, agriculture, environment) should be able to have secure and affordable access to sufficient water in terms of quantity and to safe water in terms of quality for the required potable or non-potable purposes.

What do we need to do in particular?

The main task is to implement and monitor the planned strategies vs. likely scenarios (risks), according to the Strategic Plan for a Water-Smart Lisbon produced within the B-WaterSmart Innovation Alliance using the water-smartness assessment framework (tool #34), namely:

- Further develop water reuse regarding infrastructure (build/extend/rehab distribution systems for non-potable uses), regulation & governance and business models (specific service, allow secondary users, reclaimed water pricing/incentives) (tools #17, #25)
- Assist a time-effective licensing procedure for non-potable urban water reuse (tools #27, #24) for clear and comprehensive water reuse risk assessment and management
- Replicate in Lisbon and beyond water reuse for urban irrigation – showcase the successes and lessons learned from the first pilots (2021-2024), i.e. two big parks, which consolidates to 68 ha irrigated area, are now licensed to be irrigated with reclaimed water

- Improve data curation (availability and management) (tools #20, #25)
- Improve the water energy efficiency in housing (tool #33)
- Better communicate water use in Lisbon (tool #20)
- Maintain the activities beyond B-WaterSmart

Our B-WaterSmart contribution

These strategies are supported/facilitated by the digital tools and the technology demo developed within B-WaterSmart:

- The environment for decision support and alternative course selection tool (tool #17) supports the further development of water reuse.
- The Urban Water Cycle Observatory (tool #20) supports the improved data curation and the better communication of water use in Lisbon.
- The reclaimed water distribution network water quality model (tool #24) supports a clear and comprehensive water risk assessment and management.
- The water-energy-phosphorous balance planning (tool #25) supports the further development of water reuse as well as the data curation of water availability and management.
- The Urban water reuse risk assessment tool (tool #27) is based on the relevant ISO standards and the European regulation on water reuse and supports the according strategy.
- A Climate Readiness Certification Scheme (tool #33) was developed to support the improvement of water energy efficiency in housing.
- Lisbon became a Water-Oriented LL (WOLL) and is included in the 2024 EU Atlas of the Water4All partnership. This was established during B-WaterSmart and will operate beyond 2024, therefore securing further activities after the end of the project.

2 Safeguarding ecosystems and their services to society

Water-related ecosystems provide multiple benefits and services to society and are essential for reaching several SDGs. Water-related ecosystems have significant economic, cultural, aesthetic, recreational and educational value. They help to sustain the global hydrological cycle, carbon cycle and nutrient cycles. They support water security, they provide natural freshwater, regulate flows and extreme conditions, purify water, and replenish groundwaters. Safeguarding ecosystems and their services to society describes the ability to prevent deterioration and ensure protection of water-related ecosystems, to enhance ecosystem services in urban and rural areas and to take carbon neutrality actions and promote resource efficiency in

view of environmental protection.

What do we need to do in particular?

- Green Areas: Lisbon city developed a plan for implementing of 9 green corridors since 2009 with a total increase of 20% surface area (7 out of 9 corridors concluded)
- Tagus Estuary – improvement of treatment in WWTPs and significant reduction of CSO discharges. 2030 – General Drainage Plan conclusion

Our B-WaterSmart contribution

- The green area increase should not require higher freshwater abstraction, i.e. irrigation with reclaimed water should be prioritised in a sustainable way. It is supported by the in the first strategic objective introduced environment for decision support and alternative course selection tool, the reclaimed water distribution network water quality model, the water-energy-phosphorous balance planning, and the Urban water reuse risk assessment tool (tools #17, #24, #25, #27).
- Two big parks, which consolidates to an area of 68 ha, are now irrigated with reclaimed water (the first being an existing park with a dedicated non-potable water distribution system; the second being a new park, built in 2023).

3 Boosting value creation around water

The value creation from synergies in the water-energy-resources-waste nexus through the implementation of circular economy policies and business models supports a transformation to a water-smart society.

What do we need to do in particular?

- Advance regulation & governance and business models (specific service for reclaimed water distribution (bulk and or retail supply), allow secondary users, reclaimed water pricing/incentives)

Our B-WaterSmart contribution

- The Lisbon LL Community of Practice established within B-WaterSmart is aware of the needs and will assist in creating/strengthening the foundations of more efficient governance/regulation/business models.
- Lisbon became a Water-Oriented LL (WOLL) and is included in the 2024 EU Atlas of the Water4All partnership and in the Network of WOLLs), which was established during B-WaterSmart and will operate beyond 2024.

4 Promoting adaptative change towards resilient infrastructure

The existence of governance, financial and decision-making conditions promotes adaptive change towards resilient infrastructure and enables robust planning and its implementation while assessing the effectiveness in terms of resilience.

What do we need to do in particular?

- Advance regulation & governance and business models on water reuse (specific service for reclaimed water distribution (bulk and or retail supply), allow secondary users, reclaimed water pricing/incentives)
- Implement and monitor the effectiveness and efficiency of the strategies vs. likely scenarios (risks), including infrastructure investments (for building/extending/rehabilitate) on water distribution systems for non-potable uses

Our B-WaterSmart contribution

- The strategies vs. likely scenarios (risks) to be implemented (including the resources required) and how to monitor them were set in the Strategic Plan for a Water-Smart Lisbon produced within B-WaterSmart Innovation Alliance using the water-smartness assessment framework (tool #34).
- The strategies are supported/facilitated by the digital tools and the technology demo developed, for example, by
    - the tool set on smart-water allocation, consisting of the environment for decision support and alternative course selection tool, the reclaimed water distribution network water quality model, the water-energy-phosphorous balance planning and the Urban water reuse risk assessment tool (tool #17, #25, #27, #24), which supports the decision on where and when water reuse is a sustainable solution to satisfy municipal non-potable water uses, as in the two above-mentioned parks
    - the climate readiness certification for housing (tool #33)
    - the water reclamation protocol for potable water reuse in beverage industry (tool #1), which is the protocol for safe direct potable water reuse in beer production, developed based on pilot 24/7 demo, may support progresses in water reuse regulation and practice in the EU and beyond regarding potable reuse for future aggravated water scarcity, localized needs or emergency situations.

5 Engaging citizens and actors across sectors in continuous co-learning and innovation

There is a perpetuated process of monitoring, evaluation and learning of water-smart practices amongst all relevant sectors (industry, agriculture, environment) by deliberately engaging citizens in planning, decision-making and implementation. Such an integrated, knowledge-based, and inclusive approach can ensure the awareness and capacity required to transform towards a water-smart society.

What do we need to do in particular?

- Build and maintain active a Community of Practice among the key stakeholders to help develop governance models, test and propose business models (with clear definition of roles and responsibilities) and solutions for accelerating the transformation towards a water-smart society
- Raise social awareness and literacy on water and on water reuse, for the society to be a driver and not a barrier to the required continuous innovation on water-smartness.

Our B-WaterSmart contribution

- The Lisbon LL Community of Practice established within B-WaterSmart is aware of the needs and will assist in creating/ strengthening the foundations of more efficient governance/regulation/business models, as well as of better-informed society
- This CoP will operate beyond 2024 in the scope of the Lisbon WOLL (2024 EU Atlas of WOLLs of the Water4All partnership) established during B-WaterSmart
- The demo action on the safety of direct potable use of reclaimed water in craft beer production has been an effective way to communicate the safety and promote the social acceptance of this alternative water source for current non-potable uses in Lisbon and beyond; VIRA beer has been served in events promoted by Águas do Tejo Atlântico and its name VIRA (Portuguese for ‘turn’) has the double meaning of turning (waste)water into enjoyable drinkable water (beer) and turning mindsets – ‘water quality matters not its past history’.

Our Achievements

We delivered the 6 digital tools and the technological demo/protocol foreseen, and we paved the way to ensure a legacy beyond B-WaterSmart:

2	new business opportunities, reclaimed water distribution for non-potable uses in Lisbon and climate-ready certificates
1	successful WOLL application
1	CoP planning to be active after the project end, within the Lisbon WOLL
1	Strategic plan for the next 25 years – The Lisbon Strategic Plan 2050 on Water Smartness
2	big parks, with a consolidated area of 68h, are irrigated with reclaimed water
1,500 l	of artisanal VIRA beer produced with reclaimed water to be offered in Águas do Tejo Atlântico events

Our Next Steps

The work undertaken by B-WaterSmart formed the basis for establishing a Water-Oriented Living Lab (WOLL) in Lisbon – it is one of the new WOLLs featured in the European Atlas of Water4All partnership. The water-smart strategy of the Living Lab in Lisbon encompasses strategic, governance, and social frameworks, along with digital tools and technological solutions, to advance water circularity. Notably, its strategic agenda and the deployment of digital tools for safe water reuse mark significant strides towards sustainable urban water management. The creation of the Lisbon WOLL was celebrated in the Lisbon LL World Water Day 2024 public event.

The results of the ENoLL self-assessment show that while tools & methods, co-created values and innovation partnerships, processes & projects meet the ENoLL requirements, the operational and business model would need to be improved.

3.6 LL Venice

3.6.1 Development

The Venice Living Lab a strategic initiative aiming to address key water-smart challenges in the region, focusing on the reuse and recovery of wastewater resources and sludge. Since the LL's objectives involve the application of Resource Recovery and Circular Economy principles at regional scale by maintaining the delicate equilibrium of the Venice area, the alignment and sharing of objectives with CE and climate change policies were crucial. The CoP was therefore established at a very early stage of the project and from the outset common strategic objectives were shared and defined with the key authorities/organisations in the regional area. Initially, specific meetings were held with the top-role key players to share intentions and objectives; once the alignment had been verified and the CoP stakeholders selected, a strategic work plan and agenda were jointly defined.

Specific practical objectives were the recovery of nitrogen for fertiliser production and carbon footprint reduction (regional scale), the industrial reuse of treated effluent from the Fusina municipal plant, and the valorisation of sludge from municipal wastewater treatment plants (regional scale). The jointly identified and defined means were to raise awareness and generate evidence on impacts (to facilitate rational long-term planning) and to promote competence sharing (to improve decision-making). Crucial tools were the innovative decision support systems developed in collaboration with the CoP stakeholders, which allow a robust assessment of the current landscape and identification of sustainable reuse and valorisation opportunities.

The strategic planning and agenda within the project resulted therefore from the comparison and integration of the several intentions/action programmes of utilities managing the water service, authorities and other key organisations of the regional territory; thus, from all the CoP meetings held (pre-sharing meetings with the institution top roles, which lasted about 6 months in 2021, included).

The first transversal CoP meetings on the objectives in play had made in May (remote format) and December 2021 (hybrid format), respectively for the launch of the industrial reuse target for the Fusina effluent and the official launch of all the strategic objectives (main transversal CoP meeting). This was followed by several meetings focused on specific strategic objectives. In the two years 2022-2023, among focus groups and more general transversal meetings (11%), 46 meetings were held, most of which were dedicated to the development of the two Decision Support Systems (DSS) for wastewater and sludge valorisation at regional level (70%).

It is not worth to mention specific issues discussed and contributions made in one or another CoP meeting but, by summarizing, in the development of the case study,

particularly regarding the construction of the DSS tools, the objectives, means, obstacles, and solutions were discussed and shared within the CoP, considering the opinions and positions of the main stakeholders for each aspect. As scenarios changed (e.g., climatic, regulatory), the objectives were redefined over time.

Further meetings were held in 2024 to share results and finalise work in progress. The last of these was the final transversal meeting of the Community of Practice, held in Venice on 17th July, which focused on the finalisation of the two DSS tools (sludge and water) and the presentation of the results of the combined pilot treatments for industrial reuse, highlighting the high level of quality and safety offered by the chosen combination.

3.6.2 Strategic Agenda

What it's about

As part of a "Community of Practice", innovative solutions were discussed in each B-WaterSmart Living Lab in order to develop the regional water industry more towards a circular economy. The findings from the Venice Community of Practice are summarised in this strategic agenda. The joint planning shows ways in which the region can become "water smart".

Our Vision

A strategic vision has been defined for LL Venice, which is to serve as a guideline for all stakeholders involved:

"The long-term vision of water smartness for LL Venice in 50 years corresponds to have significantly contributed to transforming the current linear vision of production and consumption towards smart and circular patterns of resources utilization and the bioeconomy.

Pursuing the vision entails raising awareness of the strategic society actors who in turn can change the vision of society through new regulations and correct media information spreading; base to design fair polices in the field.

Achieving these goals means to individuate new technologies and solutions but even and especially provide a new scientific vision to allocate them in a functioning circle while defeating misinformation, often the main leverage for building barriers."

Our Strategic Objectives

Together with the Community of Practice stakeholders, four strategic objectives have been identified for the realisation of the strategic vision, as illustrated in Figure 12, which also shows how the tools and instruments developed within B-WaterSmart facilitate their achievement.

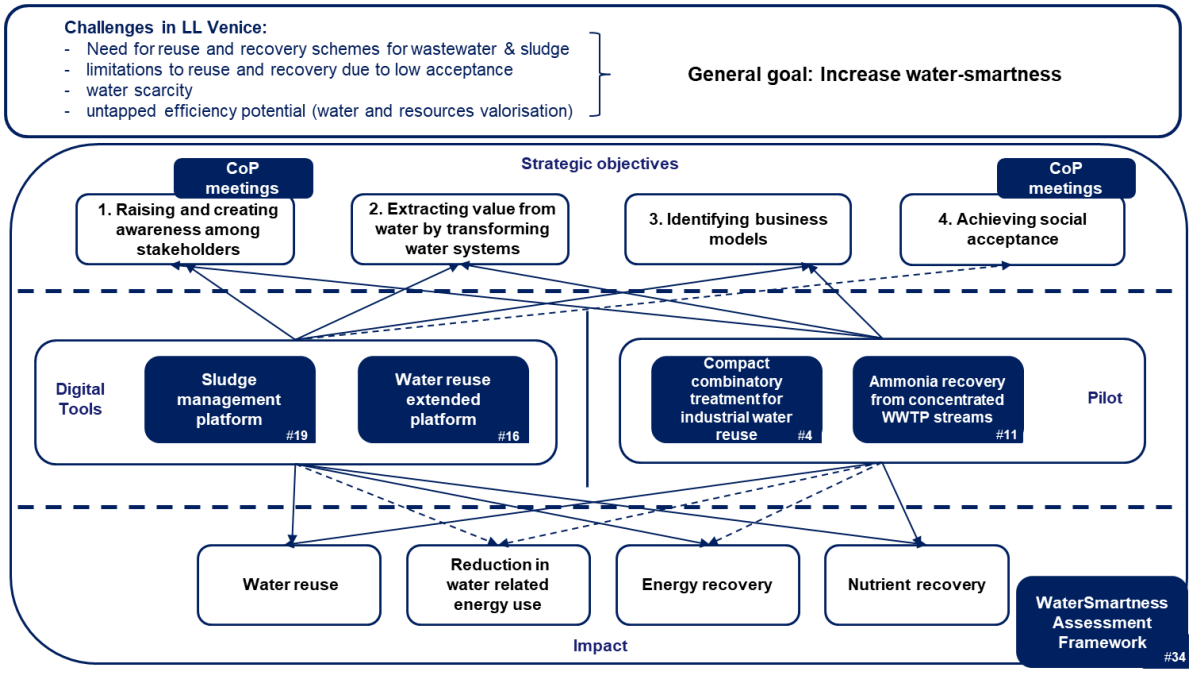

Figure 12: LL Venice in a nutshell

1 Raising and creating awareness among stakeholders on water smartness opportunities in a circular context

A level of stable knowledge of water key stakeholders, included competent authority, about key risks, impacts, and opportunity connected with recovery and reuse of water and related resources is key for the adoption and successful implementation of any water-smart solution.

The process of monitoring, evaluating, and learning from water-smart practices in all relevant sectors (industry, agriculture, environment) is continuous and involves citizens in planning, decision-making and implementation. Such an integrated, knowledge-based, and inclusive approach can ensure the conditions of awareness and capacity needed to transform the water sector into a water-smart society.

What do we need to do in particular?

- Scientific evidence for objective evaluation

- Objective risk assessment
- Easy and synergic model for competence sharing
- Regulation revision
- Unlock circularity

Our B-WaterSmart contribution

Our contribution to raising awareness among stakeholders about water smartness opportunities in a circular context is highly linked to the two developed DSS tools on water and sludge valorisation, that in addition to creating the knowledge conditions for objective assessments provide, and have provided during their development, an ideal environment to support and favour the participatory work of the CoP stakeholders. These strategic solutions improve awareness of the quality and risks associated with water reuse products and their value, by identifying ideal preconditions for more balanced regulations. The development of an effective participatory Community of Practice is another key contribution we put in place to carrying out this objective in a balanced way and finding workable solutions.

2 Extracting value from water by transforming water systems from passive to active and adaptive

Demonstration cases and associated business models provide a lever for value creation around water. These can be implemented at larger scale and/or applied at other suitable locations in the region for further value creation.

What do we need to do in particular?

- Technical feasibility and risk implication
- Technical sustainability (costs related)

Our B-WaterSmart contribution

The pursuit of value from water is a multifaceted objective that necessarily encompasses different strategies to improve water reuse and resource management. In our vision, it is a comprehensive approach that integrates technology, stakeholder engagement, knowledge dissemination and flexible management strategies. It is the combination of these efforts that provides the framework for value creation around water resource management that benefits both society and the environment. In this perspective our contribution is transversal and encompasses the technological Innovations studied as well as any other undertaken initiative and developed solution to make accessible resources currently unavailable or unexploited. This includes therefore the implementation of the Pilot Combinatory Technology (#4) on the Fusina WWTP effluent for fostering its industrial reuse by demonstrating its quality guarantee

and unlock the current unexploited potential; as well as the Nitrogen Recovery Technologies (#11) implemented to explore nitrogen extraction feasibility which in turns can contribute to sustainable nitrogen management in the wastewater sector and reduce carbon footprints of the overall system; but also the solutions that enhance knowledge (such as the DSS #16 and #19), since they can make free product management from market logics, that are as more speculative as more the knowledge on products reuse risks is lacking and disordered (as is often the case with sludge).

3 Identifying business models to promote the extraction of value from water (Circular Economy) and fostering/sustaining policies revision

Compliance with regulation can be a critical point for the implementation of water-smart solutions if the legislator shift from a balanced, informed, and fair decision making to a hyper-cautionary regulatory approach. As such, good coordinated, transparent agreements, objectives, and legislation that is respected by stakeholders supports the transformation towards a water-smart society.

Circular business models are those that combine the creation of economic value with the narrowing, slowing, or closing of resource loops. By doing this, circular business models aim to preserve the embedded value and functionality of products, and the materials within them, at their highest possible level. By closing resource loops and by slowing and narrowing resource flows, can reduce the environmental footprint of economic production and consumption.

What do we need to do in particular?

- Quality and risk characterisation (comparison among several products on the market)
- Model for market creation

Our B-WaterSmart contribution

The IT platforms for water reuse developed during B-WaterSmart aim to foster general effluent reuse. The choice of these tools is driven by the desire to create a virtual environment that facilitates discussions and collaboration among key stakeholders in the water supply chain. This addresses the challenge of creating a stable context in terms of knowledge to permit resource valorisation and value extraction from water, minimizing risks.

The choice of IT Tools for Sludge Management Valorisation is driven by supporting and promoting the best practices for sewage sludge. These tools play a crucial role in creating a mediated environment for discussions among stakeholders. The aim is to minimize risks associated with sludge management and ensure effective

valorisation practices. Both IT tools have dedicated user interfaces for updating the data through simplified procedures.

The development of the two DSS platforms in B-WaterSmart realized an economic impact. These platforms reduce freshwater use, enhance water-use efficiency, increase water reuse, and quantify potential negative impacts of overexploitation. The deployment of the DSS also facilitates the identification of incentive schemes and promotes knowledge sharing. There is also a new, general potential for cost adjustments in concessions, the facilitation of governance actions through evidence-based solutions, and additional investments driven by the attention brought to the Fusina site by the B-WaterSmart project. These contributions align with the project's sustainable water use and resource management goals.

4 Achieving social acceptance

Level of knowledge and education of stakeholders and competent authority about water-smart solutions and key risks, impacts, and uncertainties now and in the future is key for the adoption and successful implementation of any water-smart solution.

What do we need to do in particular?

- Ordered and planned increase of knowledge on Resource Recovery and Circular Economy opportunities and implications

Our B-WaterSmart contribution

Social acceptance plays a nuanced role in the Venice LL: proposed solutions do not directly involve citizens, social acceptance primarily focused on technical reuse objectives rather than the direct citizen engagement. This aspect is treated by emphasizes collaboration among various stakeholders, including trade associations and regulatory authorities, to foster "technical" acceptance of water reuse and sludge management solutions to indirectly also discouraging potential social unacceptability. Overall, the Venice LL in the B WaterSmart adopts a strategic approach to managing social acceptance through stakeholder collaboration and evidence-based practices, with a focus on addressing specific concerns and building trust over time.

Specifically, social impact includes increased awareness, cross-collaboration among stakeholders, extension of dissemination initiatives to the water sector, such as the Recycling Day initiative and other local events, aimed at broader engagement and knowledge sharing with external stakeholders. These contributions extended the impact and benefits of the project beyond its immediate participants.

Our Achievements

- The development of an effective participatory CoP that capitalised on its work within the B-WaterSmart project by officially becoming a Water-Oriented Living Lab (WOLL) in July 2024 within the Water4All Partnership. Venice WOLL is also a member of the Network of WOLLs managed by Water Europe.
- Finalized the two strategic DSS (#16, #19) for improving awareness on quality and risks of reusable water and sludge and having ideal conditions for more balanced regulations. Developed more than 20 key indicators for quantitative and qualitative assessment of water use and 12 types of assessment for more than 30 key indicators variable for evaluation of state of the art of sludge and related valorisation potentials.
- Stable overcoming of the quality barrier in relation to industrial reuse, potential extension of this type of reuse from the current 4% to 33% by 2029.
- Total regional nitrogen recovery potential established, current potential exploitation (obtained by sludge agricultural application) of 79%, potential increasing to 84% by 2029 and 90% by 2040.
- Carbon footprint savings from N recovered through ammonia stripping implementation: approximately 1,300 tonnes/year CO2 equivalent by 2029; this value would increase to over 5,000 tonnes if all current regional stripping potential were exploited.
- As a result of the effectiveness of territorial cooperation in addressing local water challenges, it is worth mentioning that the Venice LL B-WaterSmart objectives on sludge valorisation have been integrated in a regional regulation on urban and special waste management (DGR n. 988 del 09.08.2022), a reference point for supporting the strategy for sludge reuse in agriculture. In the same direction, the level of cooperation allowed stakeholders to provide feedback to a public consultation on agricultural reuse of wastewater, as the Venice CoP.
- In the field of dissemination, communication, and education, it is worth mentioning that the recycling agenda, previously conceived only for solid waste, has now been extended to the world of water, becoming the Strategic Agenda for Water Recycling, with annexes on recurrent events for systematic dissemination and communication.

Our Next Steps

Future Steps:

1. We are working on optimizing the DSS to make it usable for everybody (e.g. password and permissions, simplified update systems, links between platforms) and we will seek additional funding.
2. We have become a WOLL and want to take advantage of this by optimizing the CoP structure and management (e.g. meeting schedules, coordination, thematic priorities, especially based on the results of the B-WaterSmart project).
3. We are not yet at the point to become an ENoLL based on the ENoLL self-assessment. While we achieve a good base regarding users & reality, we would need to improve the dimensions of operation and value & impact to become an ENoLL.
4. We will broaden the scope to focus on the protection of wastewater products, starting with industry, taking into account the developed DSS and the new Urban Waste Water Treatment Directive.

4 Conclusion

The process of defining a Strategic Agenda for each LL within B-WaterSmart was started with the intention to build a framework for each LL that can provide guidance for the realisation of a water-smart future vision developed by the city or region itself.

The Strategic Agendas were built in close collaboration with local and regional stakeholders as part of the Community of Practice approach to ensure a high level of commitment of the local community to the individual objectives defined in the Strategic Agenda.

The development of the technological and digital solutions within the B-WaterSmart project already added some first achievements or at least starting points for further developments in the region to achieve the strategic objectives that were jointly defined by all relevant stakeholders.

Nevertheless, the B-WaterSmart project should not be the end but the starting point for becoming a water-smart city or region. As highlighted in each of the Strategic Agendas, there are also some specific plans for each LL how to proceed with the process after the project ended.

The further development of the project LL and institutionalisation can be a crucial factor to keep the processes and contacts established in continuation. However, the implementation of a self-governed and self-financed LL requires a long-term commitment from all stakeholders. In Figure 13 the opportunities and challenges as well as the main lessons learned are elaborated.

Therefore, the individual plans with regards to this, are varying across the different LLs. The City of Mechelen (Flanders), Venice and Lisbon have been already recognised by Water Europe as WOLLs and are part of the Network of WOLLs which is a core action of the Pillar C of the EU Partnership Water4All. The other three LL are at least considering to follow that example in the next years. Nevertheless, even in these LL other network structures are already in place that will benefit from the results and strategic agendas developed within the B-WaterSmart project.

At the time of writing, membership of ENoLL is not an option for the LLs of B-WaterSmart but may become an option after further development of the LLs. The reasons for this are individual, but the most common criteria for improvement are securing long-term governance and human resources. The step from a project LL to a sustainable, self-governed, and self-financed LL seems to be quite big. Therefore, this step requires a strong commitment from the stakeholders involved right from the

beginning of the project. A key lesson learned from the project is that the decision on the future perspective of the LL should be made at the very beginning of a project at best. Although it is clear that there is a difficulty to define the result of a collaborative project without even starting it.

Living Labs - Main lessons learned

The step from a project-based LL to a self-sustaining LL seems to be quite a big one, as additional resources have to be secured in a sustainable way for the long term. As seen in some LLs it can also be an ongoing process over the duration of different projects. However, once LLs become self-sustaining, value creation beyond the boundaries of a project or funding period as well as the creation of a cross-cutting network is possible.

Opportunities

- Fosters cross-sectoral collaboration
- Involves all stakeholders and thereby creates a common understanding and vision
- Provides continuity and stability
- Enables co-learning and cross-cutting activities

Challenges

- Requires management and facilitation of social interaction and emotional connections as a sense of belonging between the stakeholders is crucial factor
- Requires increased resources, including securing long-term funding
- Requires a high level of coordination
- Requires guidelines for collaborative work

Figure 13: The LL concept - main lessons learned, opportunities and challenges

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869171. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.